Digital learning innovations in education in response to the COVID-19 pandemic

Edited by
Lucas Kohnke, Mark Bedoya Ulla and Haoran Xie

About Frontiers

Frontiers is more than just an open access publisher of scholarly articles: it is a pioneering approach to the world of academia, radically improving the way scholarly research is managed. The grand vision of Frontiers is a world where all people have an equal opportunity to seek, share and generate knowledge. Frontiers provides immediate and permanent online open access to all its publications, but this alone is not enough to realize our grand goals.

Frontiers journal series

The Frontiers journal series is a multi-tier and interdisciplinary set of open-access, online journals, promising a paradigm shift from the current review, selection and dissemination processes in academic publishing. All Frontiers journals are driven by researchers for researchers; therefore, they constitute a service to the scholarly community. At the same time, the *Frontiers journal series* operates on a revolutionary invention, the tiered publishing system, initially addressing specific communities of scholars, and gradually climbing up to broader public understanding, thus serving the interests of the lay society, too.

Dedication to quality

Each Frontiers article is a landmark of the highest quality, thanks to genuinely collaborative interactions between authors and review editors, who include some of the world's best academicians. Research must be certified by peers before entering a stream of knowledge that may eventually reach the public - and shape society; therefore, Frontiers only applies the most rigorous and unbiased reviews. Frontiers revolutionizes research publishing by freely delivering the most outstanding research, evaluated with no bias from both the academic and social point of view. By applying the most advanced information technologies, Frontiers is catapulting scholarly publishing into a new generation.

What are Frontiers Research Topics?

Frontiers Research Topics are very popular trademarks of the *Frontiers journals series*: they are collections of at least ten articles, all centered on a particular subject. With their unique mix of varied contributions from Original Research to Review Articles, Frontiers Research Topics unify the most influential researchers, the latest key findings and historical advances in a hot research area.

Find out more on how to host your own Frontiers Research Topic or contribute to one as an author by contacting the Frontiers editorial office: frontiersin.org/about/contact

Digital learning innovations in education in response to the COVID-19 pandemic

Topic editors

Lucas Kohnke — The Education University of Hong Kong, SAR China
Mark Bedoya Ulla — Walailak University, Thailand
Haoran Xie — Lingnan University, SAR China

Table of
contents

Check for updates

Editorial: Digital learning innovations in education in response to the COVID-19 pandemic

Lucas Kohnke[1]*, Mark Bedoya Ulla[2] and Haoran Xie[3]

[1]Department of English Language Education, The Education University of Hong Kong, Tai Po, Hong Kong SAR, China, [2]School of Languages and General Education, Walailak University, Tha Sala District, Thailand, [3]Lingnan University, Tuen Mun, Hong Kong SAR, China

Editorial on the Research Topic
Digital learning innovations in education in response to the COVID-19 pandemic

Since the emergence of COVID-19 in 2020, education institutions worldwide have moved their teaching and learning programmes online and used synchronous online conferencing systems (e.g., Zoom, Microsoft Teams, Google Meet). This sudden shift in learning mode required teachers to update their pedagogical beliefs and attitudes toward technology (Gao and Cui, 2022), overcome contextual challenges (Jelińska and Paradowski, 2021) and leverage digital innovations to maximize student success (Kohnke, 2022a,b). Teachers initially found themselves unprepared and ill-equipped to cope with the daunting transition to online, blended and HyFlex learning (Moorhouse and Kohnke, 2021a,b). They had to venture outside their comfort zones and explore alternative ways to educate their students (Adedoyin and Soykan, 2020; Kohnke and Jarvis, 2021).

In our call for papers for this special issue on Digital Learning Innovations in Education in Response to the COVID-19 Pandemic, we set out to explore "innovations that have been made, challenges that have been conquered and practices that are worth keeping as educators move from emergency to sustainability." Our call was answered by authors whose articles add to the burgeoning literature on digital education in the wake of the pandemic. Notably, this special issue sheds light on how educators from various fields (e.g., English, medicine, physical education) served students when face-to-face teaching and learning were impossible.

Ulla and Perales discuss how hybrid teaching methodology differs from blended, online and remote teaching by analyzing the practices of teachers from Thailand. They argue that hybrid education is here to stay; during the transition to post-COVID-19 teaching and learning, we should implement the best practices learnt during the pandemic. This could include, for example, using augmented reality (AR) to supplement face-to-face learning. Batool found that the use of an AR applications increased students' confidence and improved their attitudes toward learning. Similarly, Nguyễn et al. investigated the use of new technologies such as virtual reality (VR) and 3D technology in fully online and blended courses in the context of professional sports training. They found that most sports trainers in Vietnam had rarely taught online before the pandemic. Therefore, many of them experienced burnout, exhaustion and low professional efficacy when forced to do so. Generally, the

transition to online learning has increased the innovative teaching practices in various fields of education, as illustrated by Deng et al..

When implementing technology, it is vital to consider the Technology Acceptance Model (see Davis, 1989) and examine usefulness, ease of use and intentions, as in a study performed by Tukiran et al. at an Indonesian university. In addition, we should explore the skills that are best suited to online and face-to-face learning, respectively. Elalouf et al. found that online and face-to-face learners in Israel were equally satisfied with their lecturers' performance. However, online learners performed better on written examinations and face-to-face learners performed better on oral examinations. It is also important to consider teachers' readiness for online teaching, as discussed by Antwi-Boampong, who tested and validated a faculty blended learning adoption model.

Poungjinda and Pathak researched law students at a local Thai university. They found that the availability of online resources, fast bandwidth and laptops had a significant impact on student academic success. This raises essential questions about equity in online learning as not all students have access to high-speed internet, laptops and a quiet space to study. In their study on medical schools in Indonesia, Turana et al. discussed the forced transition to online learning and the mental challenges it presented for students with inadequate access to the internet and laptops. Similarly, Bui et al. examined physical and psychological academic burnout at a Vietnamese university, finding that privacy concerns, prolonged online learning and a lack of community support contributed significantly to academic burnout among learners. The results of these studies imply that we should consider how to develop students' emotional intelligence (EI) and thus support their learning. Carthy et al. examined the efficacy and impact of a 5-week online EI coaching programme for Irish university students. The findings suggested that the participants' EI increased, enabling them to manage stress more effectively and increasing their academic success.

Engaging and motivating students are also essential elements of effective online teaching. Har used the game-based student-response system BadaBoom! to help students at a Hong Kong university to overcome their writing difficulties while participating in online learning and increase their engagement with the course content. Another way to engage students is to change the course delivery format. In a history education course, Petousi et al. promoted historical empathy through collaborative, interactive storytelling set in the ancient Athenian agora and using decision/branching for dialogues.

But when we incorporate digital technology in teaching, we must analyse the data to understand how students use it and what can be improved. Jones, in a UK-based study, examined the relationship between undergraduate student performance, engagement and attendance in Canvas (a learning management system). He warns that it is too simplistic to use page clicks, views and video duration to determine students' performance in an online learning environment. However, in a "big data" study involving 4,500 students at a Hong Kong university, Foung and Chen, found that analytics can provide insight into course design, language use and skills in need of improvement. Guskaroska et al. proposed a way to design student-friendly online learning environments based on their study of a composition course in the United States. Incorporating optional synchronous video sessions, multiplying communication channels and reducing unnecessary tasks increased schedule flexibility, improved time-management skills and made course delivery more efficient.

Pandemics come and go. The insights gained in this special issue will help educators respond promptly should another pandemic befall us and use digital technology to provide students with the best possible educational experience. We will be able to move forward with greater certainty about how we can maximize digital learning opportunities even if we cannot engage in face-to-face teaching and learning.

Author contributions

All authors listed have made a substantial, direct, and intellectual contribution to the work and approved it for publication.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note

All claims expressed in this article are solely those of the authors and do not necessarily represent those of their affiliated organizations, or those of the publisher, the editors and the reviewers. Any product that may be evaluated in this article, or claim that may be made by its manufacturer, is not guaranteed or endorsed by the publisher.

References

Adedoyin, O. B., and Soykan, E. (2020). Covid-19 pandemic and online learning: the challenges and opportunities. *Interact. Learn. Environ.* doi: 10.1080/10494820.2020.1813180

Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly*, 13:319–340. doi: 10.2307/249008

Gao, Y., and Cui, Y. (2022). English as a Foreign Language teachers' pedagogical beliefs about teacher roles and their agentic actions amid and after COVID-19: a case study. *RELC J.* doi: 10.1177/00336882221074110

Jelińska, M., and Paradowski, M. B. (2021). Teachers' engagement in and coping with emergency remote instruction during COVID-19-induced school closures: a multinational contextual perspective. *Online Learn. J.* 25, 303–328. doi: 10.24059/olj.v25i1.2492

Kohnke, L. (2022a). A qualitative exploration of student perspectives of chatbot use during emergency remote teaching. *Int. J. Mob. Learn. Organ.* 16, 475–488. doi: 10.1504/IJMLO.2022.125966

Kohnke, L. (2022b). A pedagogical chatbot: a supplemental language learning tool. *RELC J.* doi: 10.1177/00336882211067054

Kohnke, L., and Jarvis, A. (2021). Coping with English for Academic Purposes during COVID-19. *Sustainability* 13, 8642. doi: 10.3390/su13158642

Moorhouse, B. L., and Kohnke, L. (2021a). Thriving or surviving emergency remote teaching necessitated by COVID-19: university teachers' perspectives. *Asia-Pac. Educ. Res.* 30, 279–287. doi: 10.1007/s40299-021-00567-9

Moorhouse, B. L., and Kohnke, L. (2021b). Responses of the English-language teaching community to it he COVID-19 pandemic. *RELC J.* 52, 359–378. doi: 10.1177/00336882211053052

Check for
updates

An Analysis of the Impact and Efficacy of Online Emotional Intelligence Coaching as a Support Mechanism for University Students

Aiden Carthy[1]*[†], Wyndham Chalmers[1†], Eoghan Guiry[1] and Philip Owende[2]

[1] Research Centre for Psychology, Education and Emotional Intelligence, Technological University Dublin, Dublin, Ireland,
[2] Academic Affairs, Technological University Dublin, Dublin, Ireland

As a consequence of the COVID-19 pandemic, many college courses have pivoted to complete online delivery and colleges are also tasked with providing student supports online. It is likely this transition will last beyond any COVID-19 specific restrictions, therefore this small-scale, exploratory study examined the efficacy and impact of the provision of a 5 week online emotional intelligence (EI) coaching programme to a cohort of Irish university students (n = 19) studying at Technological University Dublin (TU Dublin). Results revealed that the average overall level of EI increased for participants following the coaching programme. Students reported that they believed the programme provided emotional support and that it also enabled them to manage academic stress more effectively and ultimately that engagement with the programme had a positive impact on their academic engagement. Taken collectively, the results of this study suggest that whilst EI coaching can be successfully delivered online, where possible, a blended approach may be optimal. However, as this is a novel and exploratory study, further confirmatory research is recommended.

Keywords: emotional intelligence, coaching, online therapy, education, student support

INTRODUCTION

Due to the COVID-19 pandemic, many college courses moved to online delivery, and it is likely that as time progresses, a substantial number of courses will continue to offer students the chance to study remotely. Furthermore, this shift to online delivery has meant that colleges and universities are faced with the new challenge of providing pastoral care as well as social and emotional supports to students in a virtual setting. One very well-established means of enabling students to develop their social skills, become more self-aware and manage stress is EI coaching (Slaski and Cartwright, 2003; Boyatzis and Saatcioglu, 2008; Nelis et al., 2009; Dacre Pool and Qualter, 2012; Carthy and McGilloway, 2015). However, to date there has been limited research conducted to investigate the efficacy of and opinions surrounding such online supports for students in third level education. As such, the current research, the first study of its kind, sought to assess the impact of a 5-week EI coaching programme that was delivered to a sample of Irish university students and to evaluate the efficacy of delivering such a course online. The study involved the provision of EI training to a cohort of Irish university students (n = 19) studying at TU Dublin, and the programme was evaluated using a mixed method design. Pre- and post- test comparison found

a statistically significant increase in overall levels of EI for students who completed the coaching programme. A focus group was also conducted with a smaller sample of participating students where students not only identified strengths of the programme but made recommendations for ways to enhance student participation moving forward. Ultimately, this novel study suggests that EI coaching can successfully be delivered online to university students. However, further confirmatory research is required.

LITERATURE REVIEW

The COVID-19 pandemic has created unprecedented challenges for third level educators and students and necessitated the creation of new and innovative means of teaching and assessment. In particular, many classes and assessments are now taking place virtually and whilst online instruction is not something new, moving to complete online delivery, particularly for courses that have traditionally been taught face to face, is a new challenge for many students and educators. In a wider context, students are also missing out on the experience of campus life, and the sense of community and the opportunities for social and emotional growth that this offers. In this regard, it is not only teaching and academic supports that need to be delivered online as the COVID-19 pandemic continues to unfold. Colleges are also challenged to virtually provide emotional support and create a sense of connectedness and community for students. However, the effectiveness of the delivery of online supports in educational contexts and the opinions of students regarding such delivery has received scant attention. One particularly well-established support for students is emotional intelligence coaching, which has been demonstrated by a wealth of studies to lead to improved academic attainment (Boyatzis and Saatcioglu, 2008; Nelis et al., 2009; Dacre Pool and Qualter, 2012; Stankovska et al., 2018; Zhoc et al., 2020), improved stress management (Slaski and Cartwright, 2003), and decreased levels of attrition (Carthy and McGilloway, 2015). However, the efficacy of online delivery of EI coaching and the attitudes and opinions of students as to engagement with online EI coaching have not previously been assessed.

Emotional Intelligence in Third Level Settings

The contemporary workplace is dynamic and multicultural and employers are increasingly seeking graduates who possess both content specific knowledge related to their area of study and social and emotional skills to enable them to communicate effectively and contribute to multidisciplinary teams (Jameson et al., 2016). Furthermore, an individual's level of EI has been demonstrated to be positively correlated with academic attainment and negatively correlated with levels of academic stress and anxiety (Stankovska et al., 2018; Zhoc et al., 2020). Therefore, third level colleges are increasingly focusing on providing students with rounded instruction that includes the development of social and emotional skills. Many college courses now include dedicated modules in areas such as personal

development that to varying degrees incorporate emotional intelligence coaching (McGinnis, 2018; Wang, 2019). EI coaching is also increasingly being offered to students as an extra-curricular support and there is a growing body of evidence attesting to the value of doing so. Broadly speaking, emotional intelligence consists of two related areas; accurately labeling and managing our own emotions (including competencies such as self-awareness, self-regard and stress management); and, accurately appraising and healthily responding to the emotions of others (including competencies such as emotion perception, interpersonal relations and assertiveness).

A wide range of studies have established that students' social and emotional skills can be improved as a result of coaching (Reilly, 2005; Boyatzis and Saatcioglu, 2008; Nelis et al., 2009; Dacre Pool and Qualter, 2012; Gilar-Corbí et al., 2018; McGinnis, 2018; Wang, 2019). A particularly robust analysis by Boyatzis and Saatcioglu (2008), involved a 20-year review of the provision of EI coaching as part of an MBA programme, synthesizing the results from 17 separate studies that were conducted with current and past students and graduates. The review confirmed that the coaching programme led to increases in emotional and social competencies and importantly that such improvements were still evident up to 7 years post-graduation. In this regard, Nelis et al. (2009) highlight that it is vital in academic settings not only for students to develop key emotional competencies but also for them to demonstrate those competencies and to continue to practise them, stating "results suggest that traits that have shown to be relatively stable over time can be modified through intensive training. However, as these traits are relatively stable, it is possible that people will come back to their "baseline" after a while if the competencies are not practised." In support of Boyatzis and Sattcioglu's (2008) original findings, more recent research has confirmed the positive impact that EI coaching can have on individual social and emotional competencies; however, due to the recency of this research the longevity of these effects is still unknow (Gilar-Corbí et al., 2018; McGinnis, 2018; Wang, 2019).

A number of studies have confirmed that in addition to the efficacy of EI coaching as a means to support students' personal development, coaching can positively impact key academic variables and promote graduate employability. For example, Unnikrishnan et al. (2015), assessed the relationship between emotional intelligence and academic achievement for a sample ($n = 532$) of medical students in South India and found a positive correlation between EI and academic achievement and between EI and level of satisfaction with career choice. Hurley et al. (2020) conducted qualitative interviews with a cohort of 12 nursing students following their completion of clinical placements, prior to which they attended an emotional intelligence coaching programme. Analysis revealed that students subjectively reported increased levels of resilience, experiences of greater levels of empathy and compassion and that students felt they were enabled to respond more effectively to the mental health concerns of patients. The authors conclude that an additional advantage of the EI coaching programme was to increase students' work readiness and potential employability. Dacre Pool and Qualter (2012) designed and delivered an 11-week EI coaching program to undergraduate students in England ($n = 134$). Interestingly,

this study measured both EI and emotional self-efficacy, which is one's belief in the ability to effectively recognize and manage emotions. The MSCEIT was employed to measure students' EI, which is based on the Salovey and Mayer model of ability EI consisting of sub-scales which measure emotion perception, using emotion, understanding emotion and managing emotion. Results revealed that there were statistically significant increases with respect to emotional self-efficacy and with respect to the understanding and managing emotions branches of the MSCEIT. However, there were no increases with respect to the perceiving or using emotions branches of the MSCEIT. Although social and emotional competencies do not easily fall into discrete categories such that any given skill can be considered exclusively an 'intrapersonal EI skill' or an 'interpersonal EI skill', there are certainly competencies that are more strongly associated with one branch of EI than the other. For example, managing emotion may be considered more strongly associated with intrapersonal EI as it relates to our ability to manage our stress and regulate our emotional state, whereas perceiving and using emotions may be considered more strongly associated with interpersonal EI as these skills are associated with appreciating and responding to the emotions of others. Although this is a somewhat arbitrary distinction, the results from Dacre Pool and Qualter's study may indicate that EI skills are best developed in stages, with an initial focus on intrapersonal EI, followed by further coaching with respect to interpersonal EI. In fact, Sigmar et al. (2012) suggest that this is a particularly effective means of developing EI skills, citing neurological evidence to support the claim that EI typically develops in stages. Dacre Pool and Qualter's study also raises an important point. Ideally, students should develop both emotional self-efficacy and emotional intelligence, as high levels of emotional self-efficacy in the absence of emotional intelligence may lead students to believe they are dealing with emotional issues more effectively than they in fact are, whereas high levels of emotional intelligence in the absence of emotional self-efficacy may mean that students will have developed emotional competencies but lack the confidence to use them.

Online Delivery of Emotional Intelligence Coaching

Although a thorough search did not find any previous studies that had specifically explored online platforms as a standalone method EI coaching in third level settings, a study conducted by Gilar-Corbí et al. (2018) introduced the possibility of online training through the use of a multimethodological approach where they implemented the use of blended EI coaching, ultimately combining online and classroom learning. Not only did the study report improvements in participants emotional competencies, but it was noted that the use of an e-learning platform in combination with more traditional teaching created the opportunity for holistic learning which might not otherwise have been possible (Gilar-Corbí et al., 2018). Beyond this singular instance of virtual EI coaching, online therapy is a well-established technique for the delivery of a wide range of psychological and medical supports. So much so, that the

American Psychiatric Association have a dedicated Committee On Telepsychiatry who have created a specific policy document with respect to telepsychiatry and college mental health in response to the COVID-19 pandemic and they claim there is "a robust evidence base that shows telepsychiatry leading to improved outcomes and higher patient satisfaction ratings" (American Psychiatric Association [APA], 2020). Berry et al. (2011) surveyed psychologists and counselors ($n = 109$) in the United States, all of whom had delivered coaching both face to face and remotely, to assess whether their perceptions of problem resolution and the quality of the professional relationship they had with clients differed depending on the mode of delivery. They found that there were no significant differences between perceived quality of relationships with clients or the reported level of problem resolution between face to face and remote delivery. However the authors do highlight some limitations with respect to this study such that the survey relied on a convenience sample and that coaches who were more "technologically savvy" may have been more likely to agree to participate as data was collected online. Kruml and Yockey (2011) provide further tentative evidence to support the efficacy of online EI coaching. Participants ($n = 75$) completed a leadership development module as part of an MBA programme in the United States which had two modes of delivery, face to face or a hybrid delivery where the majority of the instruction was delivered online culminating in a final 5 day, face to face component. Whilst the focus of this study was on the development of leadership skills rather than EI coaching *per se*, participants completed tests of EI both prior to and on completion of the leadership development programme and instruction focused on the development of leadership skills related to EI such as stress management and empathy. In essence, this was quite similar to the approach that is taken with respect to most EI coaching programmes. Analysis revealed that there was a statistically significant improvement in EI for participants following their participation in the programme and importantly, there was no significant difference found with respect to the effectiveness of the face to face and hybrid modes of delivery. Notwithstanding the arguably tangential focus of this study, it lends further, if somewhat limited, support to the efficacy of online EI coaching.

Summary

Collectively, a wealth of research findings indicate that coaching is a viable means of enabling third level students to develop social and emotional skills and that doing so can have a positive impact on key academic variables and lead to increased levels of work readiness. Previous studies further suggest that coaching programmes are particularly effective when they allow students to develop key social and emotional skills and also provide opportunities for such skills to be demonstrated and encourage continued practise. Online therapy is an established means of clinical support and a range of therapeutic interventions have been demonstrated to be clinically effective. However, a significant gap in knowledge exists, particularly in light of the ongoing global coronavirus pandemic, such that the efficacy of online delivery of EI coaching and the attitudes and opinions of students with respect to online delivery are not known.

RESEARCH QUESTIONS

(1) Does the provision of online EI coaching to Irish university students lead, on average, to increased levels of emotional intelligence?

(2) What are the perceived benefits and barriers for Irish second year university students with respect to participating in online EI coaching?

METHODOLOGY

An emotional intelligence coaching programme consisting of a series of five, 1 h, EI workshops was offered to all second year undergraduate and second year postgraduate students at Technological University Dublin in semester one of the 2020/2021 academic year. A separate set of supports is currently on offer to first year students as part of a college induction programme, hence the decision to specifically focus, in this initial study, on providing EI coaching to second year students. Due to constraints caused by the coronavirus pandemic, the programme was offered online through Microsoft Teams. There were five iterations of the programme on offer, each of which had a maximum of 20 places. To ensure consistency, each of the five programmes were offered across the same 5 weeks during the term, the same EI coach delivered all twenty-five sessions and the same content was covered in each of the five programmes. The coaching programme focused on one main topic each week, as follows; week 1 – introduction to EI and managing stress; week 2 – self-awareness; week 3 – self-regard; week 4 – building healthy interpersonal relationships; and week 5 – review and maintaining EI practise moving forward. The programme was designed to focus initially on intrapersonal EI with later workshops focused on interpersonal EI, in line with previous research findings outlined above (Dacre Pool and Qualter, 2012; Sigmar et al., 2012). Also in line with Dacre Pool and Qualter's findings, the programme had an applied focus whereby students were given practical exercises to engage with following each workshop to enable them to gain both theory and knowledge related to EI and practical skills to improve their emotional self-efficacy. To accommodate students' varying schedules, the times at which the programmes were offered varied. The EI programmes were delivered by a psychologist who is also a qualified EI coach. The coaching programmes were not streamed, i.e., any second year student, in any programme of study could apply to attend any of the programmes on offer. This meant that there was a mix of second year students in each group from across the university's various faculties and courses. The coaching programmes were advertised to all second-year students via social media, an email to all students and an additional email that was sent to students by the university's students' union. Additionally, lecturing staff were contacted and requested to bring the coaching programme to the attention of second year students. All of the advertisements for the coaching programmes contained a participant information sheet and a link that students could use to provide their name and email address to register their interest. Students who registered their interest were then separately contacted and emailed a

consent form. Once consent was confirmed, participants were sent a demographic questionnaire which included questions pertaining to participants motivations for availing of EI coaching and what it was that they hoped to gain from the programme. Participants were also required to complete a test of emotional intelligence (the TEIQue) and a personalized EI profile was generated and emailed to each participant prior to their first coaching session (see **Supplementary Appendix B**). A 1 week after the final EI session participants were requested to complete the TEIQue a second time and were also administered a questionnaire pertaining to the perceived benefits and barriers related to participating in the coaching programme. A focus group was also conducted 1 week after the coaching programme ended with a sample of participants ($n = 6$) who completed the coaching programme to glean attitudes and opinions as to the perceived efficacy of the programme. An email was sent to all students that completed the coaching programme to recruit for the focus group. As the focus group took place during a busy period in the academic calendar and in the midst of a national lockdown imposed as a result of the COVID-19 pandemic, all focus group participants were offered a €20 online shopping voucher as an incentive for participation.

Participants

There were a total of 5,399 second year students registered at TU Dublin for the first semester of the 2021–2022 academic year. 76 students registered an interest in the EI coaching programme and were emailed a participant information sheet, demographic form and consent form. Of these, 33 completed the consent and demographic forms and were registered to attend coaching sessions and 19 completed the EI coaching programme and retook the TEIQue. With respect to sex, 15 participants (79%) were female and 4 participants (21%) were male. Ten participants were aged 18–24, five participants were aged 25–34, one participant was aged 35–44, one was aged 45–54 and one participant did not give their age. Six participants who completed the coaching programme took part in the focus group.

Technological University Dublin is a recently established university, formed by the merger of three originally independent higher education institutions in Ireland. The university is currently developing a unitary quality framework and therefore, provides a potent test-bed for innovative considerations in strategies for transformative teaching and learning. Emotional intelligence coaching is also key to developing work-ready graduates (Jameson et al., 2016; Wang, 2019; Zhoc et al., 2020), therefore TU Dublin was considered an ideal setting within which to conduct this novel and exploratory study.

Sample Size

Although there is limited previous research that has specifically examined the impact of EI coaching in Irish third level educational settings, there is ample evidence to suggest that EI coaching can yield generic benefits including higher levels of emotional awareness, improvements in mental health and stress management. Therefore, the aim of this study was to recruit as many participants as possible, so an *a priori* sample size calculation was not conducted. It was hoped that a sufficient

number of students would participate in the study to allow a dependent t test to be conducted with power of .8 or greater and there was no desire to limit numbers after this level of power was achieved. Rather we hoped to be able to accommodate as many students as possible given the expected advantage to participation. Unfortunately, due to the challenges posed by the COVID-19 pandemic, students were particularly busy and were also grappling with the move to online learning. Therefore recruitment for this study was hampered and the number of participants was less than we had hoped for. Issues related to recruitment and suggestions aimed at improving the participation rate for future coaching programmes are discussed below.

The Trait Emotional Intelligence Questionnaire

The TEIQue assumes EI to be a facet of personality and as such seeks to measure respondents' perceived levels of emotional intelligence. The test comprises 153 items, yielding a global EI score, four principal factors (wellbeing, self-control, emotionality and sociability) and 15 facets of EI. These are aligned as follows; well-being (happiness, optimism and self-esteem); self-control (emotion regulation, impulse control and stress management); emotionality (empathy, relationships, emotion expression and emotion perception); and, sociability (emotion management, assertiveness and social awareness). Two additional facets (adaptability and self-motivation) contribute directly to the global trait EI score. The normative sample for the construction of the TEIQue was 1721 individuals (912 F; 764 M; 61 unreported) and all four factors and 15 facets show strong internal consistency (Petrides, 2009). Gardner and Qualter (2010) explored the concurrent and incremental validity of three separate measures of trait EI, the TEIQue, the Schutte Emotional Intelligence Scale and the Multidimensional Emotional Intelligence Assessment with a sample of 307 participants and concluded that the TEIQue was the most effective predictor of multiple psychological criteria including life satisfaction, psychological loneliness and alcohol abuse.

QUANTITATIVE RESULTS

Supplementary Table A1: Pre- and post-test average scores (see **Supplementary Appendix A**) presents the average scores, standard deviations and standard errors of the mean for pre and post scores for total EI, the four factors and fifteen facets of the TEIQue. Dependent t-tests were conducted for each of these and statistically significant results are presented in **Supplementary Table A2**: Statistically significant results of dependent t-tests (see **Supplementary Appendix A**). Effect sizes (Cohen's D) were also conducted. Results revealed that there were no statistically significant differences between pre and post-test scores for empathy, impulse control, emotion management, adaptability, assertiveness and optimism. Statistically significant differences were found for total EI, all four of the principal EI factors (wellbeing, self-control, emotionality and sociability) and nine of the fifteen facets of EI (self-esteem, emotion expression,

motivation, emotion regulation, happiness, social awareness, emotion perception index, stress management and relationships).

QUALITATIVE RESULTS

Reflexive thematic analysis was employed to analyze qualitative data arising from the focus group, as per Clarke and Braun's (2017) theoretical framework for thematic analysis. A semi-structured approach was employed whereby five themes were chosen for discussion with students based on the existing literature that was reviewed prior to the study commencing and the specific aims of the study. These themes were; (1) reasons for engagement and interest in EI coaching; (2) perceived benefits of participation with EI coaching; (3) perceived challenges and limitations related to participation with EI coaching; (4) virtual delivery; and (5) COVID-19. Analysis leaned heavily toward an inductive and systematic analytic approach, assuming a direct relationship between participant language and their intended meaning (i.e., it was assumed that coding and theme development reflect the explicit content of the data). A dual-coder methodology was employed and as per Clarke and Braun's recommendations for best practise dual coding was collaborative and reflexive with the overall purpose being to derive more robust interpretations of meaning, rather than focusing on reaching consensus of meaning. In this regard, sub-themes within the five principal thematic areas that were explored with participants have not been selected based on frequency or the number of codes associated with them. Rather, there was a specific emphasis on "meaning" and the sub-themes that have been highlighted are those that both coders, collaboratively, understood to communicate meaningful data related to the specific themes that were explored and the specific research questions that have been posed.

Focus Group Results

There were six participants in the focus group, two male and four female students from a range of academic disciplines. Demographic details for each participant are outlined in **Supplementary Table A3**: Participant information (see **Supplementary Appendix A**), as well as their chosen pseudonym.

Reason for Engagement and Interest

Considering the voluntary nature of the EI coaching, it was important to explore the reasons students chose to participate. Students stated they were drawn to the coaching programme for a number of different reasons. Four students referred to the desire to have a space where they could share and discuss feelings. For example, Hestia mentioned the desire to have a space to "let everything out. even if it was just to talk about it." One of these four students, Shalz, additionally stated that she was looking for something to fill her time, particularly since the start of the COVID-19 pandemic. Another participant, Brittany, approached the course with a more open-minded outlook and very few expectations. Brittany described herself as a "bit of a joiner" and stated that she signed up for the course as a "pure

mishap" without taking the time to consider what it was that she had signed up for. It is understandable that students would seek out activities to fill their free time, especially due to continuous lockdowns and unexpected isolation as a consequence of the COVID-19 pandemic. Specific to the college environment, research has demonstrated that participation in extracurricular activities which encourage creativity and wellbeing have been linked to lower levels of burnout and improved emotional self-regulation, ultimately leading to improved academic attainment (Fares et al., 2016; Guilmette et al., 2019; Finnerty et al., 2021).

In contrast to the other participants, Jemima was seeking ways to support and further educate others in her life as opposed to being primarily focused on seeking support for herself. She stated that as she works in the primary school sector, she thought "maybe that would be very helpful for my work with the children that I'm working with at the moment. Using what I might learn with my own work rather than for myself." Interestingly, she subsequently came to the conclusion that the information she was being presented with may not be of use in her work with young children but decided to stay and complete the course nonetheless and was "very glad that [she] stayed on."

Mental health was a consistent topic of discussion throughout the focus group and a particularly strong influencing factor for students in choosing to engage with EI coaching. More specifically, students continuously highlighted their persistent experience of stress, anxiety and a general feeling of being overwhelmed by the combination of the pressures of college life and the additional pressures caused by the COVID-19 pandemic. "I have too much things going on at once. And anxiety and stress were at an all-time high" (Hestia); "there were a ton of things, and I was dealing with a lot of anxiety" (Collin). In fact, Hestia cited the emphasis on stress and stress management in the advertisement for the coaching programme as what drew her to the course in the first place. Four students stated that feelings of isolation and stress were exacerbated as a consequence of the COVID-19 pandemic. For example, Shalz stated that "during COVID, like it was, eh, it was hard to get motivation for anything" and that she "really wanted to figure out how I could use the EI workshop to, um, improve motivation and confidence." Emotional intelligence training provided students with the opportunity to engage with and reflect meaningfully on their experiences and "get advice from the group" (Robert). The coaching sessions were a place to "let everything out" (Hestia), speak your mind, reflect, and get away from the sense of "feeling like robots" (Collin) where you "just do and do and do and do" (Collin). Ultimately, the coaching provided a welcoming and supportive environment for students.

Students considered both the immediate and the more long-term impacts that the coaching might have had and a strong motivation for participation was the perceived benefit that coaching may have with respect to seeking employment after college. For example, Robert stated that the fact that "you could use the coaching programme in regards to employment" was an enticing factor. Jemima took a more expansive perspective, suggesting that "every, em, student actually should do this as a part of their university course. I think it can be so helpful and in so many ways, like whether it's for yourself for your future

work." This led naturally to a wider discussion pertaining to the perceived benefits of participation with EI coaching.

Perceived Benefits of Emotional Intelligence Participation

As previous research has demonstrated, emotional intelligence coaching can act as a tool to help buffer life stress, ease anxiety, improve individual quality of life and enhance academic attainment (Vaillant and Davis, 2000; Parker et al., 2004; Jones et al., 2015). This spectrum of benefits was echoed within the data, with students not only stating that "well for me it was beneficial, like almost immediately" (Hestia) but also that the course "was very positive, and . . . applicable to the majority of people" (Brittany). In fact, there was a strong consensus among students that engaging with EI coaching was an overall positive experience. In this regard, five students commented on feelings of openness and community within the group, stating that it was a welcoming space within which to communicate with peers. For example, Shalz stated that she "found it beneficial because we were all allowed to express our views, and uh, we weren't judged for it." Similarly, Robert shared that "we were all actually in a safe space . . . and we were allowed to express our views whether we agreed or not on certain things and how we could say them, but we weren't judged for them."

Personal development was a strong motivation for students and they continually referred to how the course enabled them to make improvements in their personal lives and that once they started attending the workshops they were encouraged to engage in self-reflection "it kind of forced me to think about myself" (Shalz). Students specifically identified time management as a large area of growth as a result of coaching. For example, Collin remarked that EI coaching helped him to be forgiving with himself and reminded him that "you're not supposed to do absolutely everything in 1 day." Students also commented that the workshops created a necessary break in the week and that "it was nice to just take time out of your day" and "have that moment" (Brittany). Shalz noted that prior to attending the workshops, she had been finding it difficult to "get the motivation to actually start on something" however the workshops helped her to "kind of get the motivation . . . rather than just procrastinating." The emotional intelligence workshops specifically appeared to aid students in the practice of self-reflection and this was highlighted as a particular benefit throughout the focus group; Robert noted that there was a lot of emphasis in the workshops "in regard to the perception of yourself and perception of others as well" and students repeatedly described their sense of attending the emotional intelligence workshops as a "safe space" (Shalz) where they could "share feelings and thoughts about different things." Students recognized that the conversations they had weren't the types of conversations they would typically have with their friends from college. Robert specifically noted that these deeper, more meaningful, conversations were what helped him realize "there is resilience in the fact that you can go, okay, I've kind of come back down there, how do I move back up again?" Overall, the students reported a sense of being on a journey of self-discovery and this is summed up by Brittany who stated "it wasn't just

like general comments, it was also allowing people to grow weekly."

A second perceived benefit of involvement with the workshops was the positive impact that doing so had on academic attainment. Previous research on emotional intelligence has shown that high levels of emotional intelligence are correlated with high levels of academic attainment, so it is perhaps unsurprising that those students who participated in the emotional intelligence workshops reported perceived academic improvements as a consequence (Vaillant and Davis, 2000; Parker et al., 2004; Jones et al., 2015). Of course, based on self-reports alone, it is impossible to determine if the EI coaching was the sole source for any potential changes in academic performance for these students; however, based on the current data, one can conclude that while it may not be the sole contributing factor, students certainly found the coaching to have a meaningful impact on their academic experiences. As per the demographic information provided above, students represented a wide range of academic fields. The general consensus was that students' mental health and academic performance had been negatively impacted as a consequence of COVID-19. However, four students noted an improvement in their academic performance after having attended EI coaching sessions. Collin, for example, commented specifically that a perceived benefit of attending the workshops was that his "GPA went up" and Shalz went even further, claiming that "I don't think my GPA was ever that high ... I was actually so shocked." It is clear from the data that students directly connected attending the EI workshops with their improved academic attainment. Hestia for example simply stated that "the course helped a lot" and Robert added that the ability to take a "step back" give him the space to focus and reflect which ultimately led to improved grades.

A final concept that students discussed related to perceived benefits of engaging with EI coaching was "use it or lose it" and in this regard, students appreciated that in order to maintain and improve EI, one must actively and continuously engage in the practice of this skill or risk losing it. Students recognized the importance of routine, with Robert remarking that "doing it every week is definitely beneficial (Brittany nodding in agreement) because then you're in a routine of it." Although students found the timing and frequency of the course helpful "the once a week was definitely beneficial" (Robert) they also stated they would like the course to have been longer than it was and that they felt as though there was "not enough of it" (Robert) and that they were "just stopping in the middle of nowhere" (Brittany). Robert further remarked that even though the course was helpful at the time it was taking place, once it ended, "maybe courses take over, maybe stresses take over, maybe life takes over ... and, although you've done it, maybe you've implemented some, but not enough" (Robert) and what you learnt from the course slowly starts to slip away as your practice begins to fade. What these comments suggest is that whilst students found the emotional intelligence course to be beneficial as a whole, to maintain these benefits over time, the skills learnt throughout the course need to be meaningfully practised on an ongoing basis. Although the students "very much liked" (Collin) the course, that does not mean it was without any

perceived flaws and indeed perceived challenges and limitations will now be discussed.

Challenges and Limitations

Interestingly, one of the primary areas where students perceived improvements could be made was not with respect to the workshops directly but rather with respect to how they were advertised. With respect to the content of the advertising, students noted a particular emphasis on stress and stress management and as Hestia claimed, this might have deterred some students from participating due to a belief that "it was just for stress." An additional concern for students arising from the manner in which the course was advertised was the perception that it would consist of a "group talking about problems" (Hestia). A fundamental issue for students was the fact that the course was advertised by email and whilst email is a convenient means of communication and an efficient way to ensure that all students have an equal opportunity to engage, students made it abundantly clear that they get "hundreds of emails" every week (Brittany), and cited this as one of the reasons that some students may not have engaged with the course. Students suggested that advertising through social media and presentations in lectures would be preferable and likely more effective ways to advertise future courses.

That there was some confusion as to what exactly emotional intelligence is was apparent. Brittany stated that although she anticipated the course would outline the "steps in order to, you know, grow it [emotional intelligence], and how to apply it to your life," nevertheless "it was a little bit more personal" than she had expected. Shalz mentioned being confused by the "complicated" term "emotional intelligence," however, three other students noted that they had previously learnt about emotional intelligence. Both Brittany and Robert said that they had heard about it "in secondary school," whereas Shalz stated that she had "read a book about emotional intelligence."

A second area where students felt improvement could be made, was with respect to the timing of the course. The most prominent concern was that it didn't run for long enough and that it felt "like we're just stopping in the middle of nowhere, and there was a sense of panic" (Brittany). Students made the argument that it felt as though the course was cut short and that even though it started off "very well and you have it all, and you have a block of it which is fantastic" (Robert) when the course ended after its allotted 5 weeks there was a perception that students were left with "nothing (*Shalz nods in agreement*)" (Robert), ultimately leaving them with a sense of "what do we do now?" (Brittany). Additionally, Collin commented on the point in the semester when the course began, noting that he "was already spiraling" and made the suggestion that it would have been preferable to have the course start at the very beginning of the academic semester. In fact, one of the strongest findings to emerge from this focus group was the sense that the coaching programme simply didn't run for long enough with, Robert suggesting a check-in "4-weeks/5-weeks into your next semester, or even in mid-semester" would have been nice as a way to see "have you used the tools or have you forgotten the tools." Furthermore, with respect to the "use

it or lose it" sub-theme, Robert made the argument that this "refresher" to the longer 5-week course would remind students of the importance of practising the skills they had been taught and further encourage students to incorporate these lessons into their daily practice. It is clear from students' feedback that while the timing wasn't necessarily a determining factor in whether or not these particular students chose to participate or not, it was a rather important factor in determining their overall experience of the course. Moving forward, it is recommended that some adaptations to the course be made, particularly in relation to the final session or sessions such that a more comprehensive "round off" (Brittany) is included as well as the possibility for "refresher" sessions so that students feel prepared to continue practising the skills they developed even after completing the course.

Virtual Delivery

Due to limitations imposed by the pandemic, the EI coaching programme was held virtually via the online video conference platform Microsoft Teams, so this was specifically explored with students. Students initially shared that they started to struggle when classes "went to virtual" as they found that this "new" approach to university and studying left them feeling "very stressed" (Collin). Furthermore, students shared that they found it "very hard to kind of engage on that personal level in the [virtual] classrooms" (Robert), making the argument that due to the virtual classroom format, they felt less connected to their peers and perceived receiving less support than they would in a traditional classroom setting. Interestingly, while students did have difficulties with the transition to virtual education as a whole, they acknowledged that the emotional intelligence coaching programme "was delivered very, very well" (Collin) and also noted that they "didn't have any technical difficulties" (Collin). In this regard, students noted that the EI course was unique in that "it's different than just maybe attending a zoom meeting where somebody is kind of lecturing, and everyone is listening" (Jemima). Instead, the emotional intelligence course gave "the space to everyone to talk, and then listen" (Jemima), which ultimately fostered a sense of openness amongst the group, creating a "safe space" (Robert; Shalz; Brittany) for students to come together and share. In contrast to a traditional classroom setting where students might be "sitting in an environment where you were in a bit of a circle chatting" and there would be "a lot more pressure on you" (Brittany), the virtual meetings provided students with the opportunity to "share, um, a lot of personal details and a lot of personal things without feeling as vulnerable" (Collin). Furthermore, in addition to feeling "less pried on" (Brittany), in a virtual setting, students recognized that there was a sense of freedom associated with the virtual delivery such that, "If you didn't want to talk about your feelings, you could, you know, just back away a bit" (Brittany).

While there was a general consensus that students felt rather safe and secure in the online workshops, two students did comment on differences they perceived compared to standard, in-person interactions. For example, Jemima compared the abrupt end to each call to "switching off the tele," whereas Robert suggested that it would be nice "for the whole group to hang on a little bit longer if people wanted to." So, while virtual delivery is

convenient in many ways, it may arguably create a bubble effect and unintentionally isolate participants from each other.

Ultimately, based on feedback, it would seem as though the virtual delivery was very popular, if not for its convenience, then for the comfort and security that it provided students. Furthermore, while some students seemed unsure as to whether or not they would prefer to attend an in-person or virtual course had they been given a choice, others ventured so far as to say that "it would possibly be better that it's online, especially managed in the way it was, versus having to be in an actual classroom" (Brittany). Whilst students in this particular study had mixed views with respect to online delivery, ultimately this data suggests that virtual delivery may be less of a hindrance than previously suspected.

COVID-19

Considering the timing and context of the current research and, more importantly, the fact that the EI workshops were offered to students in the midst of one of The Republic of Ireland's COVID-19 national lockdowns, the pandemic was unsurprisingly a reoccurring topic of conversation for a number of reasons. COVID-19 not only impacted the way in which the programme was delivered to students (i.e., virtual instead of in person), it also had a large impact on students' reasons for participating and their overall experience of the programme.

On a positive note, students reported that the emotional intelligence programme helped them better process the effects of the pandemic, "deal with the fact that you were having an awful lot of difficulties in that respect" (Robert) and provided them with a space to "express your thoughts and feelings that you wouldn't really talk about" (Shalz). This seemed to be particularly important as students like Shalz noted that they would not have shared so openly with their friends and that the emotional intelligence group was a much-needed release from the stress they were feeling. This was of particular importance to students given the restrictions imposed as a result of COVID-19 and the fact that they were no longer able to experience daily interactions with peers "agreeing, disagreeing, laughing like, just being like interacting and socializing" (Collin). The pandemic took an emotional toll, with some students noting that they were "feeling like more insecure" (Shalz) after almost a year of social distancing and national lockdowns and that "being around people seems more different now" (Shalz).

The pandemic necessitated quick adjustments and adaptations to be made to the manner in which the programme was delivered and for students the pandemic necessitated fundamental changes with respect to their college lives and how they interacted with staff and fellow students. Ultimately, it is hoped that the feedback gleaned from students will aid in the development of the programme so that it can continue to be tailored to fit their needs.

DISCUSSION

This study sought to evaluate the impact and efficacy of the provision of an online emotional intelligence coaching programme for Irish undergraduate students. Utilizing a

mixed method design, the study included the completion of pre- and post-tests of an emotional intelligence measure (i.e., the Trait Emotional Intelligence Questionnaire; Petrides, 2009) and a semi-structured focus group with students who availed of EI coaching.

Notwithstanding the fact that there were some areas where coaching did not lead to improved EI scores for students, the findings from this study align with those of previous studies that have demonstrated that emotional intelligence coaching can be beneficial and lead to increases in overall levels of EI (Mayer et al., 1999; Slaski and Cartwright, 2003; Boyatzis and Saatcioglu, 2008; Ruiz-Aranda et al., 2012; Gilar-Corbí et al., 2018). Specifically, the findings from this study suggest that online coaching can be an effective means of delivery, although further research is required to confirm this. As previously noted, there has been limited research conducted pertaining to the efficacy of online EI coaching when used in isolation, however, these exploratory findings do align with aspects of the study conducted by Gilar-Corbí et al. (2018), which found benefits of online EI coaching when used in a hybrid setting. In this regard, as a result of recent technological advancements and what some scholars are referring to as the "fourth industrial revolution" and as a response to the COVID-19 pandemic there has been a push toward strictly virtual forms of media, connection, and information sharing (Schwab, 2017; Saeed et al., 2020). Within educational contexts, educators have had to make the challenging transition to distance learning, finding new ways to engage with students in a meaningful manner not only with respect to teaching and learning but also in terms of pastoral care and emotional support (Ortiz-Rodríguez et al., 2005). Particularly given the continuing constraints arising from COVID-19 the results of this study are welcome in that they demonstrate tentative support for the efficacy of online EI coaching as a social and emotional support for students and suggest that such coaching may potentially positively impact academic attainment although much further confirmatory research is required in this regard. That said, it is important to recognize that whilst the COVID-19 pandemic necessitated rapid and wide-ranging changes to be made to teaching and learning practises, arguably many such changes were trends that had already been established and the COVID-19 pandemic simply hastened their adoption. For example, prior to the pandemic, as per above, there was already a move toward increased use of online learning and increased use of technology in learning environments. At the very least, these changes have stimulated reflection and debate and it is likely that blended learning and the use of online engagement will increase even when the COVID-19 pandemic hopefully ends. Therefore, the findings from this study extend beyond the impact of the ongoing pandemic.

Although students in this study commented favorably on the content and delivery of the EI coaching programme, there were a number of perceived limitations and areas where improvements could potentially be made. With respect to advertising and recruitment, in light of the positive impact the programme had, it was regrettable that uptake was poor and so few students engaged with the coaching programme. Specific to the manner in which the programme was described to students in the informational emails and leaflets that were sent to them, students were clearly given the false impression that the principal emphasis of coaching was stress management. Some students may also be unfamiliar with the term "emotional intelligence," therefore providing a definition of this term in addition to the ways in which the course might help them improve their self-awareness, self-regulation, social skills, empathy and motivation would be beneficial (Craig, 2019). It may also be beneficial to include testimonials in any advertisements from students who had previously participated, as they could provide a unique perspective on the course that researchers and developers might not be able to. In addition to reducing the possibility for confusion this may also encourage students to seek further information prior to engaging with coaching.

In addition to considering the content of any advertisement it is also vital to consider the means by which it will be communicated to students. A key factor to consider in this regard is how students typically choose to communicate with each other and what their preferences are with respect to receiving communication from their university. Since its development in the early 1970s email has grown in popularity and is now the primary form of communication between businesses and within the higher education sector (Turville, 2019). However, as students in this study pointed out, it is not uncommon for them to have "hundreds of emails" (Brittany) land in their college email account each week, which can easily become overwhelming and likely lead to information overload and important messages being missed. Furthermore, although email is the preferred means of communication for many educators, research has confirmed that in recent years the communication preferences of teenagers and young adults have changed, particularly due to the availability of more expansive social media platforms such as Instagram and Facebook (Subramanian, 2017; Vidhya and Kalaiselvi, 2020). In fact, research aimed at specifically assessing the communication preferences of university distance learners echoes this and found that, when given a choice, students chose email only 19% percent of the time (Schutte and Andrianatos, 2018). With this in mind, whilst email remains an effective means of ensuring all students receive a given message, it is recommended that a primary advertisement should be supplemented by alternative methods such as shared posts on campus social media or endorsement by lecturers and students who had previously completed the course.

A particularly novel element of this study was the delivery of EI coaching to students online. Traditionally, education and training has involved face-to-face and in person instruction and as such, it was anticipated that moving forward this would be the preference for students once the restrictions imposed by the COVID-19 pandemic hopefully come to an end. However, students' views in this regard were nuanced and there were mixed opinions with respect to virtual versus in person delivery. Participants commented that the online nature of the programme made it convenient and specifically highlighted that they felt they had been provided with a space that was "safe" (Robert; Shalz; Brittany). In light of the dramatic shift in recent years toward online communication, the findings from this, admittedly small-scale study, support the assertion that we are arguably transitioning toward a new normal where students are more

comfortable and confident engaging online and increasingly opt for this medium over traditional face to face instruction. These findings, however, contradict more recent research pertaining to students' preference for virtual or face-to-face learning which has found that while some students did find online learning to be an opportunity to explore through technology, the majority of students preferred in person learning as they believed that it allowed for greater connection to peers and instructors as well as helping to increase productivity (Bali and Liu, 2018; Alawamleh et al., 2020). That said, there remains limited research on the topic, suggesting that further research is required. As stated above however, the results from this study are nuanced and it is worth noting that there were several concerns raised by students, including the fact that engagement with online coaching can feel less personal and a particularly important finding arising from this study is that students reported feeling less accountable than they believed they would have been had they attended coaching in person. While this finding echoes the results of Bali and Liu (2018), Alawamleh et al. (2020), it is complicated by the fact that although students reported feeling less accountable, a perceived benefit of online coaching for students was that they felt they could more easily "just back away a bit" when they felt emotionally challenged or overwhelmed and that they were "less pried on" (Brittany).

Considering the above, there are two possible solutions to address the concerns raised by students whilst maintaining the perceived benefits of online delivery. The first is to offer a blended delivery, such that an initial workshop takes place in person followed by a number of online workshops and another final in person concluding workshop. This again falls in line with the research conducted by Gilar-Corbí et al. (2018) and would be an opportunity to expand on their initial findings and further explore the efficacy of hybrid coaching methods. Alternatively, and a likely simpler option, would be to allow students when registering for a course of this kind to select a delivery preference, either virtual or face-to-face. Further research is of course required and in particular the efficacy of online versus face to face delivery could be compared.

With respect to the timing and duration of the coaching programme, the general consensus amongst students was that the timing was "brilliant" (Brittany), although one student did state a preference for the programme to begin at the very start of semester one. The most pressing concern for students and a strong finding that was gleaned from the qualitative data was that on completion of the coaching programme students were left with a sense of wanting more and with an overwhelming feeling of "what do we do now?" (Brittany). Furthermore, students recognized the importance of having a "routine" (Robert) which relates to the concept of "use it or lose it" such that in order to maintain and develop a new skill, one must actively and continuously engage in the practice of the skill in question (McDonough, 2016). Students' recognition of the importance of "routine" (Robert) echoes findings in recent research which highlight the importance of habit formation, and particularly the importance of repetition and reinforcement during social-emotional and psychological learning (Fiorella, 2020; Harvey et al., 2021). This is a particularly important finding as there are

both practical and ethical concerns to be considered. Arguably from an ethical standpoint, to provide support of any kind to students only to have them feel a sense of loss or, at worst, a sense of abandonment, once that support is withdrawn, is highly problematic. This is certainly something that needs to be addressed with respect to this particular programme given the feedback from our students in this regard. To address this ethical concern in addition to students concerns regarding falling out of practice on completion of a coaching programme, there are two proposed solutions. Firstly, the course could simply be extended from 5- to 6-weeks, with the 6th week of the course focusing on future planning and what students might do on their own to maintain the skills they learned during the previous workshops. Although this was touched upon in the final week of this iteration of the programme, qualitative data suggests it may have been rushed and could be afforded greater emphasis. This would not only allow students to ask any final questions they might have about emotional intelligence, but as students approach the end of the programme it would frame emotional intelligence as a life skill and highlight the importance of taking steps to promote positive mental health on an ongoing basis as part of a healthy lifestyle. The second option would be to provide a follow-up session for students several weeks after the completion of the initial course to check-in, ensure they have continued to use the skills they developed, and to answer any questions that students might have about emotional intelligence at that time. These options are not mutually exclusive and could of course be employed concurrently.

Taken collectively, the results of this exploratory study indicate that EI coaching can be effectively delivered online to undergraduate students and that doing so can enable students to benefit personally and academically. Although coaching, in this instance, was delivered online as a response to the COVID-19 pandemic and it had been anticipated that future iterations of the coaching programme would revert to in person delivery, feedback from students was generally positive and there were in fact some specific benefits that were highlighted. For example, students stated that they felt less exposed in an online environment and the option to switch off their monitor and take a step back when necessary made online engagement a preferable option to in person coaching. Further research is recommended to explore this area in detail. For example, future research could ascertain whether there are specific student cohorts for whom online delivery is most appealing and future research could also compare the efficacy of online versus in person delivery for specific student cohorts.

LIMITATIONS

The most notable challenges with respect to conducting this study were the difficulties with participant recruitment due to the issues caused by the COVID-19 pandemic, and as a consequence of this, the study's small sample size. While the study did utilize convivence sampling and the EI coaching was available to all second-year students at TU Dublin, recruitment was lower than originally anticipated and, as we heard from

students, advertisement of the course could have been more effective. Another key area of concern when considering sample size is the possibility for generalization. While these exploratory findings are promising, given the study's small sample size and limited population demographics, further research will need to be conducted to assess the generalizability of these results. Finally, it is important to note that given the number of t-tests conducted there is an inflated risk that type 1 error may have occurred.

CONCLUSION

Extensive research has demonstrated that EI coaching can lead to improvements in stress management and enhanced social and emotional competencies. However, relatively few studies have specifically assessed the provision of EI training to students in third level educational settings, and even less research has been conducted to assess the online delivery of EI training. With that in mind and considering that the present study worked with a limited sample size, it is advised that further confirmatory research be conducted to assess the efficacy of online EI coaching in third level settings, in particular by employing an expanded sample in terms of both size and diversity. For example, it would be worthwhile assessing the impact and efficacy of online EI coaching across variables such as ethnicity, age and course of study. Based on the findings from this study, a blended delivery is recommended, where possible, and the importance of follow up engagement with participants has been highlighted. Ultimately, the unique virtual component of this study called attention to the ways in which course delivery has rapidly changed over the course of the COVID-19 pandemic, and given that this is a novel area of research, much further investigation is required.

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by the Blanchardstown Campus Ethics Committee. The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

All authors listed have made a substantial, direct, and intellectual contribution to the work, and approved it for publication.

FUNDING

SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/feduc.2022.861564/full#supplementary-material

REFERENCES

Alawamleh, M., Al-Twait, L. M., and Al-Saht, G. R. (2020). The effect of online learning on communication between instructors and students during Covid-19 pandemic. *Asian Educ. Dev. Stud. [Online ahead of print]* doi: 10.1108/AEDS-06-2020-0131

American Psychiatric Association [APA] (2020). *College Mental Health,Telepsychiatry: Best Practises, Policy Considerations & COVID-19.* Available online at: https://www.psychiatry.org/psychiatrists/practice/telepsychiatry (accessed January 20, 2022).

Bali, S., and Liu, M. C. (2018). Students' perceptions toward online learning and face-to-face learning courses. *J. Phys. Conf. Ser.* 1108:12094. doi: 10.1088/1742-6596/1108/1/012094

Berry, R., Ashby, J., Gnilka, P., and Matheny, K. (2011). A comparison of face-to-face and distance coaching practices: coaches' perceptions of the role of the working alliance in problem resolution. *Consult. Psychol. J.: Pract. Res.* 63, 243–253.

Boyatzis, R., and Saatcioglu, A. (2008). A 20-year view of trying to develop emotional, social and cognitive intelligence competencies in graduate management education. *J. Manage. Dev.* 27, 92–108. doi: 10.1108/02621710810840785

Carthy, A., and McGilloway, S. (2015). 'Thinking outside the box' – engaging students and promoting learning through emotional and social skills development. *Proc. Soc. Behav. Sci.* 191c, 2655–2600. doi: 10.1016/j.sbspro.2015.04.647

Clarke, V., and Braun, V. (2017). Thematic analysis. *J. Positive Psychol.* 12, 297–298.

Craig, H. (2019). *The Theories of Emotional Intelligence Explained.* Available online at: https://positivepsychology.com/emotional-intelligence-theories/ (accessed January 21, 2022).

Dacre Pool, L., and Qualter, P. (2012). Improving emotional intelligence and emotional self efficacy through a teaching intervention or university students. *Learn. Individ. Differ.* 22, 306–312. doi: 10.1016/j.lindif.2012.01.010

Fares, J., Saadeddin, Z., Al Tabosh, H., Aridi, H., El Mouhayyar, C., Koleilat, M., et al. (2016). Extracurricular activities associated with stress and burnout in preclinical medical students. *J. Epidemiol. Glob. Health* 6, 177–185. doi: 10.1016/j.jegh.2015.10.003

Finnerty, R., Marshall, S., Imbault, C., and Trainor, L. (2021). Extracurricular activities and wellbeing: results from a survey of undergraduate university students during COVID-19 lockdown restrictions. *Front. Psychol.* 12:647402. doi: 10.3389/fpsyg.2021.647402

Fiorella, L. (2020). The science of habit and its implications for student learning and well-being. *Educ. Psychol. Rev.* 32, 603–625. doi: 10.1007/s10648-020-09525-1

Gardner, J., and Qualter, P. (2010). Concurrent and incremental validity of three emotional intelligence (EI) measures. *Australian J. Psychol.* 62, 5–13. doi: 10.1080/00049530903312857

Gilar-Corbí, R., Pozo-Rico, T., Sánchez, B., and Castejón, J. L. (2018). Can emotional competence be taught in higher education? A randomized experimental study of an emotional intelligence training program using a multimethodological approach. *Front. Psychol.* 9:1039. doi: 10.3389/fpsyg.2018.01039

Guilmette, M., Mulvihill, K., Villemaire-Krajden, R., and Barker, E. (2019). Past and present participation in extracurricular activities is associated with adaptive

self-regulation of goals, academic success, and emotional wellbeing among university students. *Learn. Individ. Differ.* 73, 8–15. doi: 10.1016/j.lindif.2019. 04.006

Harvey, A. G., Callaway, C. A., Zieve, G. G., Gumport, N. B., and Armstrong, C. C. (2021). Applying the science of habit formation to evidence-based psychological treatments for mental illness. *Perspect. Psychol. Sci. [Online ahead of print]* doi: 10.1177/1745691621995752

Hurley, J., Hutchinson, M., Kozlowski, D., Gadd, M., and Van Vorst, S. (2020). Emotional intelligence as a mechanism to build resilience and non-technical skills in undergraduate nurses undertaking clinical placement. *Int. J. Ment. Health Nurs.* 29, 47–55. doi: 10.1111/inm.12607

Jameson, A., Carthy, A., McGuinness, C., and McSweeney, F. (2016). Emotional intelligence and graduates – employers' perspectives. *Proc. Soc. Behav. Sci.* 228, 515–522. doi: 10.1016/j.sbspro.2016.07.079

Jones, D., Greenberg, M., and Crowley, M. (2015). Early social-emotional functioning and public health: the relationship between kindergarten social competence and future wellness. *Am. J. Public Health* 105, 2283–2290. doi: 10.2105/AJPH.2015.302630

Kruml, S., and Yockey, M. (2011). Developing the emotionally intelligent leader: instructional issues. *J. Leadership Organ. Stud.* 18, 207–215. doi: 10.1111/j.1365-2834.2008.00957.x

Mayer, J., Caruso, D., and Salovey, P. (1999). Emotional intelligence meets traditional standards for an intelligence. *Intelligence* 27, 267–298. doi: 10.1016/s0160-2896(99)00016-1

McDonough, I. (2016). *Use It or Lose It: Redefining an Old Idea.* Available online at: https://www.todaysgeriatricmedicine.com/archive/MJ16p5.shtml (accessed January 22, 2022).

McGinnis, E. J. (2018). Developing the emotional intelligence of undergraduate music education majors: an exploratory study using bradberry and greaves' (2009) emotional intelligence 2.0. *J. Music Teacher Educ.* 27, 11–22. doi: 10.1177/1057083717723919

Nelis, D., Quoidbach, J., Mikolajczak, M., and Hansenne, M. (2009). Increasing emotional intelligence: (how) is it possible? *Pers. Individ. Differ.* 47, 36–41. doi: 10.1016/j.paid.2009.01.046

Ortiz-Rodríguez, M., Telg, R., Irani, T., Roberts, T., and Rhoades, E. (2005). College students' perceptions of quality in distance education: the importance of communication. *Q. Rev. Distance Educ.* 6, 97–105.

Parker, J., Summerfeldt, L., Hogan, M., and Majeski, S. (2004). Emotional intelligence and academic success: examining the transition from high school to university. *Pers. Individ. Differ.* 36, 163–172.

Petrides, K. V. (2009). "Psychometric properties of the trait emotional intelligence questionnaire," in *Advances in the Assessment of Emotional Intelligence*, eds C. Stough, D. H. Saklofske, and J. D. Parker (New York, NY: Springer).

Reilly, P. (2005). Teaching law students how to feel: using negotiations training to increase emotional intelligence. *Negotiation J.* 21, 301–314. doi: 10.1111/j.1571-9979.2005.00065.x

Ruiz-Aranda, D., Castillo, R., Salguero, J., Cabello, R., Fernández-Berrocal, P., and Balluerka, N. (2012). Short and midterm effects of emotional intelligence training on adolescent mental health. *J. Adolescent Health* 51, 462–467. doi: 10.1016/j.jadohealth.2012.02.00

Saeed, N., Bader, A., Al-Naffouri, T., and Alouini, M. (2020). When wireless communication responds to covid-19: combating the pandemic and saving the economy. *Front. Commun. Netw.* 1:566853. doi: 10.3389/frcmn.2020.566853

Schutte, B. J., and Andrianatos, A. A. (2018). *Identifying the Communication Preferences of Distance Education Students at the Unit for Open Distance Learning.* NWU. Available online at: https://repository.nwu.ac.za/handle/10394/31054 (accessed February 7, 2022).

Schwab, K. (2017). *The Fourth Industrial Revolution.* New York, NY: Penguin.

Sigmar, L., Hynes, G., and Hill, K. (2012). Strategies for teaching social and emotional intelligence in business communication. *Bus. Commun. Q.* 75, 301–317. doi: 10.1177/1080569912450312

Slaski, M., and Cartwright, S. (2003). Emotional intelligence training and its implications for stress, health and performance. *Stress Health* 19, 233–239. doi: 10.1002/smi.979

Stankovska, G., Dimitrovski, D., Angelkoska, S., Ibraimi, Z., and Uka, V. (2018). Emotional intelligence, test anxiety and academic stress among university students. *BCES Conference Books* 16, 157–164.

Subramanian, K. (2017). Influence of social media in interpersonal communication. *Int. J. Sci. Progr. Res.* 109, 70–75. doi: 10.3390/ijerph17061883

Turville, J. (2019). From "you've got mail" to email overload. *Techné: Res. Philos. Technol.* 23, 1–25. doi: 10.5840/techne201951093

Unnikrishnan, B., Darshan, B., Kulkarni, V., Thapar, R., Mithra, P., Kumar, N., et al. (2015). Association of emotional intelligence with academic performance among medical students in South India. *Asian J. Pharmaceutical Clin. Res.* 8, 300–302.

Vaillant, G., and Davis, J. (2000). Social/Emotional intelligence and midlife resilience in schoolboys with low tested intelligence. *Am. J. Orthopsychiatry* 70, 215–222. doi: 10.1037/h0087783

Vidhya, R., and Kalaiselvi, K. (2020). A study on influence of social media in interpersonal communication. *Ann. Roman. Soc. Cell Biol.* 24, 948–954.

Wang, C. (2019). Facilitating the emotional intelligence development of students: use of technological pedagogical content knowledge (TPACK). *J. Hospital. Leisure Sport Tourism Educ.* 25:100198. doi: 10.1016/j.jhlste.2019.100198

Zhoc, K. C. H., King, R. B., Chung, T. S. H., and Chen, J. (2020). Emotionally intelligent students are more engaged and successful: examining the role of emotional intelligence in higher education. *Eur. J. Psychol. Educ.* 35, 839–863. doi: 10.1007/s10212-019-00458-0

ORIGINAL RESEARCH

OPEN ACCESS

Impact on Medical Education and the Medical Student's Attitude, Practice, Mental Health, After One Year of the Covid-19 Pandemic in Indonesia

Yuda Turana[1]*, Putu Asih Primatanti[2], Wawang S. Sukarya[3], Marwito Wiyanto[4], Artha Budi Susila Duarsa[5], Raditya Wratsangka[6], Donna Adriani[6], Poppy Kristina Sasmita[1], Ecie Budiyanti[1], Dasti Anditiarina[5], Dina Qurratu Ainin[5], Kartika Sari[2], I. Wayan Darwata[2], Yesi Astri[7], Thia Prameswarie[7], Alya Tursina[8], Wida Purbaningsih[8], Andree Kurniawan[9], Allen Widysanto[9], Meddy Setiawan[10], Mochamad Ma'roef[10], Suryani Yuliyanti[11], Rahayu[11], Sukma Sahadewa[12], Budiono Raharjo[12], Sri Maria Puji Lestari[13], Astri Pinilih[13], Dewa Ayu Liona Dewi[14], Mulya Dinata[14], Tissa Octavira Permatasari[15], Frista Martha Rahayu[15], Zwasta Pribadi Mahardhika[16], Sri Wahyu Herlinawati[16], Nur Hayati[17], Winny Setyonugroho[17], Wienta Diarsvitri[18], Diah Purwaningsari[18], Linda Chiuman[19], Shofiyah Latief[20], Rahma Triliana[21], Gladys Dwiani Tinovella Tubarad[22], Ida Ayu Triastuti[23], Andi Weri Sompa[24], Frisca Angreni[4], Siska Anggreini Lubis[25], Noer Saelan Tadjudin[26], Gea Pandhita[3], Ratih Pramuningtyas[27], Muhammad Anas[28], Ratih Ayuningtiyas[29], July Ivone[30], Ferdiana Yunita[31], Handayani[32], Vivien Puspitasari[9], Marshell Tendean[33], Ika Suswanti[1] and Felicia Kurniawan[1]

[1] School of Medicine and Health Sciences, Atma Jaya Catholic University of Indonesia, Jakarta, Indonesia, [2] Faculty of Medicine and Health Sciences, Warmadewa University, Denpasar, Indonesia, [3] Faculty of Medicine, Universitas Muhammadiyah Prof. DR. HAMKA, Jakarta, Indonesia, [4] Faculty of Medicine, Universitas Kristen Indonesia, Jakarta, Indonesia, [5] Faculty of Medicine, Al-Azhar Islamic University, Mataram, Indonesia, [6] Faculty of Medicine, Universitas Trisakti, Jakarta, Indonesia, [7] Faculty of Medicine, University of Muhammadiyah Palembang, Palembang, Indonesia, [8] Faculty of Medicine, Universitas Islam Bandung, Bandung, Indonesia, [9] Faculty of Medicine, Pelita Harapan University, Tangerang, Indonesia, [10] Faculty of Medicine, University of Muhammadiyah Malang, Malang, Indonesia, [11] Faculty of Medicine, Universitas Islam Sultan Agung, Semarang, Indonesia, [12] Faculty of Medicine, Wijaya Kusuma Surabaya University, Surabaya, Indonesia, [13] Faculty of Medicine, Malahayati University, Bandar Lampung, Indonesia, [14] Faculty of Medicine, Widya Mandala Catholic University, Surabaya, Indonesia, [15] Faculty of Medicine, Universitas Swadaya Gunung Jati, Cirebon, Indonesia, [16] Faculty of Medicine, YARSI University, Jakarta, Indonesia, [17] Faculty of Medicine and Health Sciences, Universitas Muhammadiyah Yogyakarta, Yogyakarta, Indonesia, [18] Faculty of Medicine, Hang Tuah University, Surabaya, Indonesia, [19] Faculty of Medicine, Universitas Prima Indonesia, Medan, Indonesia, [20] Faculty of Medicine, Universitas Muslim Indonesia, Makassar, Indonesia, [21] Faculty of Medicine, Universitas Islam Malang (UNISMA), Malang, Indonesia, [22] Faculty of Medicine and Health, Universitas Muhammadiyah Jakarta, Jakarta, Indonesia, [23] Faculty of Medicine, Duta Wacana Christian University, Yogyakarta, Indonesia, [24] Faculty of Medicine and Health Sciences, Muhammadiyah University of Makassar, Makassar, Indonesia, [25] Faculty of Medicine, Islamic University of North Sumatera, Medan, Indonesia, [26] Faculty of Medicine, Tarumanagara University, Jakarta, Indonesia, [27] Faculty of Medicine, Universitas Muhammadiyah Surakarta, Surakarta, Indonesia, [28] Faculty of Medicine, Universitas Muhammadiyah Surabaya, Surabaya, Indonesia, [29] Faculty of Medicine, Abdurrab University, Pekanbaru, Indonesia, [30] Faculty of Medicine, Maranatha Christian University, Bandung, Indonesia, [31] Faculty of Medicine, Universitas Gunadarma, Depok, Indonesia, [32] Faculty of Medicine, Universitas Nahdlatul Ulama Surabaya, Surabaya, Indonesia, [33] Faculty of Medicine and Health Science UKRIDA, Jakarta, Indonesia

Introduction: The COVID-19 pandemic has caused disruptions in educational institutions across the country, prompting medical schools to adopt online learning systems. This study aims to determine impact on medical education and the medical student's attitude, practice, mental health after 1 year of the Covid-19 pandemic in Indonesia.

Methods: This study utilized a cross-sectional design. An online questionnaire was distributed digitally to 49 medical schools in Indonesia from February–May 2021. A total of 7,949 medical students participated in this study. Sampling was carried out based on a purposive technique whose inclusion criteria were active college students. This research used questionnaires distributed in online version among 49 medical faculties that belong to The Association of Indonesian Private Medical Faculty. Instruments included demographic database, medical education status, experience with medical tele-education, ownership types of electronic devices, availability of technologies, programs of education methods, career plans, attitudes toward pandemic, and the mental health of respondents. Univariate and bivariate statistical analysis was conducted to determine the association of variables. All statistical analyses using (IBM) SPSS version 22.0.

Results: Most of the respondents were female (69.4%), the mean age was 20.9 ± 2.1 years. More than half of the respondents (58.7%) reported that they have adequate skills in using digital devices. Most of them (74%) agreed that e-learning can be implemented in Indonesia. The infrastructure aspects that require attention are Internet access and the type of supporting devices. The pandemic also has an impact on the sustainability of the education program. It was found that 28.1% were experiencing financial problems, 2.1% postponed their education due to this problems. The delay of the education process was 32.6% and 47.5% delays in the clinical education phase. Around 4% student being sick, self-isolation and taking care sick family. the pandemic was found to affect students' interests and future career plans (34%). The majority of students (52.2%) are concerned that the pandemic will limit their opportunities to become specialists. Nearly 40% of respondents expressed anxiety symptoms about a variety of issues for several days. About a third of respondents feel sad, depressed, and hopeless for a few days.

Conclusion: The infrastructure and competency of its users are required for E-learning to be successful. The majority of medical students believe that e-learning can be adopted in Indonesia and that their capacity to use electronic devices is good. However, access to the internet remains a problem. On the other side, the pandemic has disrupted the education process and mental health, with fears of being infected with SARS-CoV-2, the loss of opportunities to apply for specialty training, and the potential for increased financial difficulties among medical students. Our findings can be used to assess the current educational process in medical schools and maximize e-learning as an alternative means of preparing doctors for the future.

Keywords: COVID-19, e-learning, Indonesia, medical education, students

INTRODUCTION

The COVID-19 pandemic has significantly impacted all aspects of life, including education at the medical faculty (Alsoufi et al., 2020; Kelly et al., 2020; Kim et al., 2020). Before the Covid-19 pandemic, the learning system in Indonesia almost entirely used the physical meeting method, students and lecturers met face-to-face. This pandemic demands that all levels of education are expected to adopt a different education model than usual.

The emergence of integrated technology in education has forced us to adapt to the changing learning environment, the demands for flexibility in methodology, and the need to enhance creativity and innovation in learning (Onyema, 2019). One method to achieve those demands is through e-learning. To have an effective learning model, all parties must be prepared, including network internet connection providers, educational institutions as education providers, and students as service recipients.

Because Indonesia is an archipelagic country with a big population [Badan Pusat Statistik (BPS), 2019; Ministry of Health of Republic Indonesia, 2019], the pandemic's impact on medical education has been different in Indonesia than in other countries, resulting in unique conditions. This is due to the enormous number of medical faculties in various provinces and islands significant differences in infrastructure, internet connections, and human resources.

At the beginning of the pandemic, there have been many international publications on the impact of the pandemic on e-learning, attitude, practice, and mental health (Alsoufi et al., 2020; Duraku and Hoxha, 2020; Kecojevic et al., 2020; Kelly et al., 2020; Kim et al., 2020; Onyema et al., 2020; Maulana, 2021; Nishimura et al., 2021). Onyema et al. (2020) found various obstacles in implementing e-learning education, such as infrastructure problems (network access, electricity) and poor digital skills. Besides those factors, the pandemic has also impacted the mental and financial health of medical students. The study showed that students who have concerns about a shift toward online education have a higher chance of experiencing general anxiety and depression (Maulana, 2021; Nishimura et al., 2021). This is linked to academic difficulties such as a lack of attention and focus in lessons and learning during the pandemic, as well as students' ability to understand, and expertise in completing tasks that are typically shortened (Duraku and Hoxha, 2020; Kecojevic et al., 2020).

After a year, however, numerous quick changes occur, resulting in a new mindset and practice in the "new normal" situation. Because there has been no large-scale research involving multiple medical faculties in Indonesia on the impact of a pandemic, the findings of this study can help to enrich data used to describe situations 1 year following a pandemic. It is known that mental health problems are an issue for medical students (Alsoufi et al., 2020; Maulana, 2021; Nishimura et al., 2021), but it is also known that mental health conditions are influenced by pandemic triggers and previous social, economic, ethnic, and health conditions (Browning et al., 2021). So this research will provide an additional picture of the severity of the impact of mental health on students in Indonesia compared to other countries or cultures. This study can also indicate the state of the pandemic's impact on medical education in low- and middle-income countries, as well as provide feedback for the improvement of various stakeholders involved in medical education.

There are currently few studies in Indonesia that discuss the impact of the COVID-19 pandemic on the medical education program and medical student (Daroedono et al., 2020; Agiananda and Lukman, 2021). Study by Daroedono et al. (2020) shows that the inhibiting factor of online learning for medical students is the problem of unstable internet signal. Research conducted by Agiananda and Lukman (2021) shows that medical students and health workers are a vulnerable group to physical and psychological disorders during a pandemic. These studies, on the other hand, used a small number of subjects, had a limited number of research variables, and only included subjects from one medical faculty. With cross-institutional and province data, we hope to determine the severity of the pandemic's impact on some of these factors, such as medical students' attitudes, practices, and mental health.

MATERIALS AND METHODS

The study using a cross-sectional design; was conducted in February-May 2021. The goal of this study was to determine impact on medical education and the medical student's attitude, practice, mental health after 1 year of the Covid-19 pandemic in Indonesia. The total number of medical students in Indonesia is estimated at 62,500 (Medico-19 Research Group Fakultas Kedokteran Universitas Indonesia, 2021). Sampling was carried out using a purposive technique with a target respondent of 10,000 students.

This research used questionnaires distributed in online version using Google form among 49 medical faculties that belong to The Association of Indonesian Private Medical Faculty. The Google form questionnaire was distributed through the coordinators of each medical school. Subsequently, the coordinators disseminated information to students through short messages, WhatsApp, or private emails. The author created the questionnaire without asking for respondents' identities to ensure data confidentiality. All participants who filled out the questionnaire were considered to have agreed to participate in the study, as stated in the research informed consent section of the Google Form. Ethical approval was obtained from the Ethics Committee at Atma Jaya Catholic University of Indonesia (No. 14/06/KEP-FKIKUAJ/2021). Informed consent was obtained from all respondents.

This study uses questions utilized in the study of Alsoufi et al. (2020) with modifications, translation and adapted to the situation in Indonesia. Independent translators translated the questionnaire in Bahasa and discuss with three authors to ensure the same intended meaning. The questionnaire had an internal consistency, as evidenced by Cronbach's alpha values of 0.821 for the Bahasa version.

Instruments included demographic database, medical education status, experience with medical tele-education, ownership types of electronic devices, availability of technologies, programs of education methods, career plans, attitudes toward pandemic, and the mental health of respondents. Several questions about mental health disorders, especially anxiety and depression, were taken from GAD-7 and PHQ-2 (Kroenke et al., 2003; Spitzer et al., 2006).

Univariate statistical analysis was conducted to investigate respondents' characteristics and responses using frequency and percentage descriptively. In addition, we used the chi-square test to determine the association of variables by group of years of education. We performed all statistical analyses using (IBM) SPSS version 22.0.

RESULTS

There were 7,949 students from 49 medical faculties in Indonesia who complete the questionnaire (response rate: 79%). Based

on demographic characteristics, most of the respondents were female (n = 5513, 69.4%) with an average age of 20.9 ± 2.1 years. Most of the respondents were in their 1st to 4th year of education (71.7%) (**Table 1**).

Impact on Medical Education

In the readiness assessment of infrastructure section of the questionnaire (i.e., the availability and skills of technology usage), it was discovered that 15.8% of respondents stated that they have less/sufficient skills in using electronic devices, while the majority of respondents stated that their ability to use electronic devices is good/very good (58.7%/25.5%). The majority of respondents reported having access to a 4G internet connection (93.7%). However, less than half of the respondents (48.7%) and only a few (6.7%) reported having a good and very good internet connection. Most participants own smartphones and personal computers, but only 30.4% support Augmented Reality and 49.3% support high-resolution camera phones. Less than a third of the respondents (27.5%) independently sought various external educational sources. Most of them (71.6%) depended solely on the lectures prepared by their faculty. Data on social media usage is crucial during a pandemic. Instagram is used by about 60% of the people in this study. Only 2% of the population uses Facebook. About 16% of the students said they don't use social media at all (**Table 2**).

The pandemic also has an impact on the sustainability of the education program. It was found that 13.2% delayed the education program for socio-economic reasons and other reasons (**Table 3**). Although One-third of the respondents (28.1%) were experiencing financial problems, but only 168 (2.1%) respondents postponed their education due to economic problems.

Another impact of the pandemic is the delay of the education process in the faculty where they studied (32.6%) and Almost half of the respondents (47.5%) stated that they experienced delays in the clinical education process (**Table 3**). Around 4% student being sick, self-isolation and taking care family who is sick.

In addition, the pandemic was found to affect students' interests and future career plans (34%), the analysis results revealed that the year of education did not significantly affect the change in interest in public health and infection control. Nevertheless, students in their 2nd to 4th years of study had a higher tendency to change their interests than students in their 1st year and students with study periods of more than 5 years (**Table 3**).

The majority of students (80%) continued their online learning, and only a small percentage (39.5%) engaged in self-learning through a program that the faculty did not provide. Regarding student activities during the pandemic outside of learning, most respondents (86%) spent time with their families. Only a few participated in volunteering (6%) and research (7.8%) activities (**Table 3**). However, most respondents became a source of information to provide advice or guidance for their friends (97%) and family (56.9%).

The Medical Student's Attitude and Practice

Table 4 shows that, while students agreed/strongly agreed that it would be better to help out in the hospital during the pandemic (69.1%). More than 70% of the respondents were concerned about being infected with COVID-19 during clinical practice or in the community. More than half of the students (55.7%) said the pandemic situation would impact their progress and careers as medical students. The majority of students (52.2%) are concerned that the pandemic will limit their opportunities to become specialists. Meanwhile, most respondents agree or strongly agreed (81.4%) that medical faculty efforts to guide career development are admirable. Worried about losing chances to apply for specialty training due to COVID-19 (80.6%).

Table 5 shows the respondents' understanding of e-learning. More than 90% of respondents stated that e-learning is a comprehensive digital electronic environment displaying curriculum, interactive, provides digital multimedia content (91.2%). However, less than 80% stated that One of the benefits of e-learning with live content is that the scholar receives instant

TABLE 1 | Student characteristics.

Variables (n = 7,949)	n (%)
Age [Mean (SD)]	20.9 (2.1)
Gender	
Male	2,436 (30.6)
Female	5,513 (69.4)
Year Level (n%)	
1–4	5,698 (71.7)
5–7	2,251 (28.3)

TABLE 2 | E-learning tools, technology and provider during pandemic.

E-Learning Tools, Technology and Provider		n	%
Technology proficiency	Beginner	38	0.5
	Basic	1,215	15.3
	Intermediate	4,670	58.7
	Advance	2,026	25.5
Internet connection	Poor	440	5.5
	Standard	3,109	39.1
	Good	3,871	48.7
	Very good	529	6.7
Digital e-learning tools	Personal Computer	7,287	91.7
	Table or iPad	1,525	19.2
	Smartphone	5,770	72.6
E-learning technology	Augmented Reality	2,414	30.4
	High Definition Phone Camera	3,915	49.3
	Fourth Generation (4G) internet service	7,445	93.7
E-learning provider	University	5,688	71.6
	Private education centers/course	75	0.9
	Various educational sources	2,186	27.5
Social media usage	Facebook	140	1.8
	Twitter	297	3.7
	Instagram	5,128	65.2
	Other social media	991	12.5
	Not	1,339	16.8

TABLE 3 | Pandemic impact on education program.

Variables		Total (%) %
Impact on Education Program		
Suspending education program on my own volition	Have not suspended educational program	6,901 86.8
	Suspended educational program due to financial problems	168 2.1
	Suspended educational program due to my social status and personal responsibilities	587 7.4
	Suspended educational program due to other reasons	293 3.7
Education program being suspended/postponed by Faculty	Yes	2,589 32.6
	No	5,360 67.4
Clinical training program being suspended	Yes	3,773 47.5
	No	4,176 52.5
Currently working/volunteering in a Hospital	Yes as a student in the clinical education/as volunteer	4,353 54.8
	No, I do not currently work at the hospital	1,735 21.8
	Student at the preclinical education stage,	1,861 23.4
Activities During Pandemic (more than one answer)	Feel unwell and have implemented self-isolation	187 2.4
	Looking after ill patient/family member	124 1.6
	Preparing for medical license exams/Post-graduate exams	314 4.0
	Volunteering activities	475 6.0
	Medical research activities	623 7.8
	Medical education through online platform	6,360 80.0
	My medical education program at the university was not disrupted	3,136 39.5
	Spending more time with family	6,840 86.0
	Exercise and improving physical fitness	3,129 39.4
	Play video games	1,886 23.7
	Self-learning through a program not provided by faculty	1,053 13.2
	Watch TV	3,841 48.3
	Read non-medical books	2,168 27.3
	Rest and relax	2,626 33.0
Impact on career plan and future interest		
COVID-19 pandemic affected your career plan and future interest (more than one answer)	Affected my career plan and future interest	2,704 34.0
	Interested in public health	1,629 20.5
	Interested in infectious disease	1,249 15.7
	No affected career plan or future interest	4,283 53.9
Becoming source of Covid-19 pandemic information (more than one answer)	Family	4,524 56.9
	Friend	7,711 97.0
Overview of the COVID-19 Pandemic Affecting Career Plans and Future Interests		
1st year	This has affected future career plans or interests	484 32.4
	I became interested in Public Health	346 23.2
	I became interested in Infection Treatment	259 17.4
	Does not affect my future career plans or interests	810 54.3
Year 2–4	This has affected future career plans or interests	1,453 34.5
	I became interested in Public Health	870 20.7
	I became interested in Infection Treatment	699 16.6
	Does not affect my future career plans or interests	2,227 52.9
5th year or more	This has affected future career plans or interests	767 34.1
	I became interested in Public Health	413 18.3
	I became interested in Infection Treatment	291 12.9
	Does not affect my future career plans or interests	1,246 55.4

feedback from the instructor (77.8%). Most respondents (88.2%) consider e-learning as part of tele-education.

The majority of respondents (74.0%) agreed that e-learning can be implemented easily in Indonesia. Nevertheless, only half (49.5%) agreed that the quality of internet services can support e-learning. Most students agreed/strongly agreed (83.9%) that e-learning can cover the practical aspects of medical education curriculum. However, less than 60% agreed/strongly agreed that e-learning is more convenient and flexible than conventional learning (58.2%). In 71.6% of respondents consider

the e-testing can replace the current traditional testing methods in medical faculty, while 77.3% agreed/strongly agreed that interaction between students and lecturers is possible through e-learning (**Table 6**).

Table 7 shows that the majority of respondents (94.6%) use the internet regularly in their learning process and the majority (84.7%) use it to download the material related to the learning medical study. In large number of the respondents (90.5%) share learning materials that they get to other students. Most of the respondents (93.4%) also use

the internet to study with friends or in groups. More than 90% of students participated in online Health Education programs and used the internet to attend medical-related trainings during the pandemic. Most students also use online learning to grasp a medical concept, which may include attending Problem Based Learning training (80.7%). However, less than 60% of students use applications or medical education programs to obtain medical training certifications. In terms of gadget usage, as many as 95.8% of students use their computers.

TABLE 4 | Medical students' attitudes toward effects the COVID-19 pandemic.

Attitudes toward Covid-19 pandemic	Strongly disagree	Disagree	agree	Strongly agree
	n (%)	n (%)	n (%)	n (%)
Better helping hospitals during COVID-19 pandemic	193 (2.4)	1,849 (23.3)	4,515 (56.8)	977 (12.3)
Wasting potential learning capability during pandemic	200 (2.5)	1,451 (18.3)	4,381 (55.1)	1,830 (23.0)
Negatively affecting my personal well-being	601 (7.6)	3,363 (42.3)	3,157 (39.7)	580 (7.3)
Afraid of being exposed to COVID-19 during clinical practice/training	290 (3.6)	1,351 (17.0)	4,345 (54.7)	1,336 (16.8)
Afraid of being exposed to COVID-19 in the community	228 (2.9)	1,293 (16.3)	4,825 (60.7)	1,422 (17.9)
COVID-19 has no effect on my educational progress and career	631 (7.9)	3,802 (47.8)	2,920 (36.7)	412 (5.2)
COVID-19 has no effect on enrolling in specialties requiring safe care	580 (7.3)	3,568 (44.9)	2,955 (37.2)	410 (5.2)
Admire the way medical faculty efforts to provide guidance for career development	199 (2.5)	1,076 (13.5)	5,302 (66.7)	1,167 (14.7)
Worried about losing chances to apply for specialty training due to COVID-19	125 (1.6)	1,097 (13.8)	4,879 (61.4)	1,530 (19.2)

TABLE 5 | Knowledge of medical students toward e-learning.

Variables	True	False	I don't know
	n (%)	n (%)	n (%)
E-Learning depends on a comprehensive digital electronic environment displaying educational curriculum through electronic networks	7,253 (91.2)	212 (2.7)	484 (6.1)
E-Learning is an interactive system that provides an opportunity for learning through Information and Telecommunication Technology	7,455 (93.8)	243 (3.1)	251 (3.2)
E-learning provides a digital multimedia content (written text, audio, video and images)	7,517 (94.6)	201 (2.5)	231 (2.9)
One of the benefits of E-learning with live content is that the scholar receives instant feedback from the instructor	6,184 (77.8)	1,022 (12.9)	743 (9.3)
E-learning is considered a type of tele-education	7,012 (88.2)	269 (3.4)	668 (8.4)

TABLE 6 | Attitudes of medical students toward e-learning.

Variables	Strongly disagree	Disagree	agree	Strongly agree
	n (%)	n (%)	n (%)	n (%)
E-learning is applicable in Indonesia	291 (3.7)	1,265 (15.9)	5,881 (74.0)	512 (0.4)
E-Learning is a possible substitute for standard medical education	1,543 (19.4)	3,458 (43.5)	2,714 (34.1)	234 (2.9)
An interactive electronic content with discussions can be achieved through e-learning	467 (5.9)	1,544 (19.4)	5,405 (68.0)	533 (6.7)
Most medical students can use live online learning content	294 (3.7)	679 (8.5)	6,058 (76.2)	918 (11.5)
E-learning can be used for Clinical aspects of Medical Sciences	810 (10.2)	2,275 (28.6)	4,521 (56.9)	343 (4.3)
E-learning can cover the practical aspect of medical education curriculum	339 (4.3)	939 (11.8)	6,053 (76.1)	618 (7.8)
E-testing can replace the current traditional testing methods in medical faculties	687 (8.6)	1,577 (19.8)	4,861 (61.2)	824 (10.4)
E-Learning is more convenient and flexible than conventional learning	759 (9.5)	2,562 (32.2)	4,119 (51.8)	509 (6.4)
The quality of internet services in Indonesia can support E-learning	1,137 (14.3)	2,562 (32.2)	3,938 (49.5)	312 (3.9)
It is possible to obtain medical educational material through the internet	361 (4.5)	759 (9.5)	6,076 (76.4)	753 (9.5)
Interaction between students and lecturers is possible through E-learning	462 (5.8)	1,341 (16.9)	5,651 (71.1)	495 (6.2)
Medical students have financial difficulty in gaining access to E-learning	368 (4.6)	1,203 (15.1)	5,197 (65.4)	1,181 (14.9)
Universities/Faculty shall succeed in establishing E-learning programs for medical students	424 (5.3)	1,294 (16.3)	5,753 (72.4)	478 (6.0)

Around 50–60% percent of respondents in each region of Indonesia said the internet service was good, with only about 10% saying it was very good. Fewer than half of respondents in some provinces, such as East Nusa Tenggara (NTT), Papua, and South Sumatra, said they had good internet service (**Figures 1A,B**).

Medical Student's Mental Health

The relationship between years of education, clinical phase, and financial status and mental health was investigated in this study. Although not statistically significant, there was an increasing trend in anxiety symptoms ($p = 0.12$). Meanwhile, depression symptoms differed between first-year students and those in their final year ($p = 0.003$) (**Table 8**).

Medical students frequently experience mental health issues. Nearly 40% of respondents expressed anxiety symptoms about a variety of issues for several days. About a third of respondents feel sad, depressed, and hopeless for a few days, but some respondents state that this condition occurs almost every day (4–5.6%). The tendency to worry increases with the length of the study year (**Table 8**). Nearly a third of respondents said they were having financial difficulties (28.1%). Further investigation reveals that there is no significant relationship between financial situation and anxiety or depression symptoms (**Table 9**).

DISCUSSION

The emergence of the pandemic has had a significant impact on the educational patterns at the faculty of medicine, particularly in terms of virtual learning methods and activities. The COVID-19 pandemic can be seen as a catalyst for the transformation of medical education. Today, the role of e-learning is becoming increasingly important. Many factors influence the success of e-learning, particularly from the perspective of its users and, of course, the supporting facilities. E-learning can provide students with greater educational opportunities while also improving faculty effectiveness and efficiency. However, e-learning requires a certain level of human resource and infrastructure readiness, which is unavailable in developing countries like Indonesia. Institutional readiness to adopt e-learning is contingent on aligning new tools that consider the educational and economic context (Frehywot et al., 2013).

Impact on Medical Education

Our research shows that the availability of facilities in Indonesia, such as devices, skills, and accessibility to support e-learning, is satisfactory. These findings support the feasibility of e-learning implementation for medical students. The primary factors for executing distance learning are technical resources and infrastructure. Subsequently, understanding technology, financial, institutional, educator, and student barriers are critical for successfully implementing distance learning in medical education (Al-Balas et al., 2020).

The majority of students use their smartphones to supplement their learning. The study of Kapasia et al. (2020) reported that most students used android phones to access e-learning. These results support the need for smartphone applications that provide

access to online learning and medical education lectures. It also drives the need to provide interactive sessions *via* optimized smartphones (Alsoufi et al., 2020). Because the screen on a mobile phone is smaller, it must be supported by easy-to-read writing fonts and a variety of applications that support this function.

According to a study by Daroedono et al. (2020) students rely more on mobile data without a backup (such as WiFi). According to a survey conducted by the Indonesian Internet Service Providers Association in 2019–2020, 97% of respondents used data packages (quota) from cellular operators [Indonesia Survey Center (ISC), 2020]. implying that they rely heavily on the consistency and reliability of cellular phone signals, as well as additional expenses for internet data package fees. Other studies show that most students use android phones to access e-learning during the lockdown; the students experienced various issues, including anxiety, depression, poor internet connectivity, and a poor learning environment at home. Students from remote areas face greater challenges (Kapasia et al., 2020). This emphasizes the importance of interventions to create positive learning environments for students from socially vulnerable groups.

In our study, the majority of students used 4G technology and were proficient with their devices. Furthermore, during the pandemic, the Republic of Indonesia's Ministry of Education and Culture provided university students with a 15 GB/month internet data quota (Ministry of Education and Culture Republic of Indonesia, 2021). However, almost half of the students stated that they had less and poor internet/network connections. The geographical constraint of Indonesia, which is very large and consists of islands, is one of the causes of access problems in some areas (CNN Indonesia, 2020). This condition becomes a challenge because of building networks and data facilities in certain areas. Our study found that less than 50% of students from three regions, namely East Nusa Tenggara (NTT), Papua, and South Sumatra, had good/excellent access to the internet. This is something that needs to be considered when it comes to improving the region's communication infrastructure. The success of e-learning implementation is dependent on cross-sectoral collaboration, which includes telecommunications service providers. It is hoped that good quality internet connection will be evenly distributed in all regions in Indonesia. Telecommunication companies should provide high-quality internet coverage to students. Building a unified educational platform for all medical schools may be the optimal solution to address the disparity between student satisfaction and instructor performance in distance learning (Al-Balas et al., 2020).

The pandemic impacted the medical education process in Indonesia, as much as 32.6 and 47.5% of the education program and Clinical training program being suspended. Half of the students stated that they were afraid of being exposed to COVID-19 during clinical practice/training, 54.7%. Harries et al. (2021), in their study, reported that the pandemic had a moderate effect on their stress and anxiety levels, with 84.1% of respondents feeling at least somewhat anxious. Meanwhile, delays in academic activities were positively associated with anxiety symptoms in college students in China (Wenjun et al., 2020). Another impact of the pandemic on medical students, they felt the pandemic had

TABLE 7 | Medical students' practice evaluation of e-learning.

Variables (Yes answer)	n (%)
Were you awarded certificates through online training courses related to the medical field?	4,175 (52.5)
D id you participate in any online medical education program during this period?	7,285 (91.6)
Do you download content related to your medical education in a periodic manner?	6,734 (84.7)
Do you share educational material with your fellow medical students at your faculty?	7,193 (90.5)
Did you use the internet to study with a friend or a group of friends through online meetings?	7,423 (93.4)
Did you use the internet to attend a course in Problem-based learning format?	6,416 (80.7)
Do you utilize your personal computer in online studying?	7,616 (95.8)
Do you use the internet regularly in your studies?	7,520 (94.6)
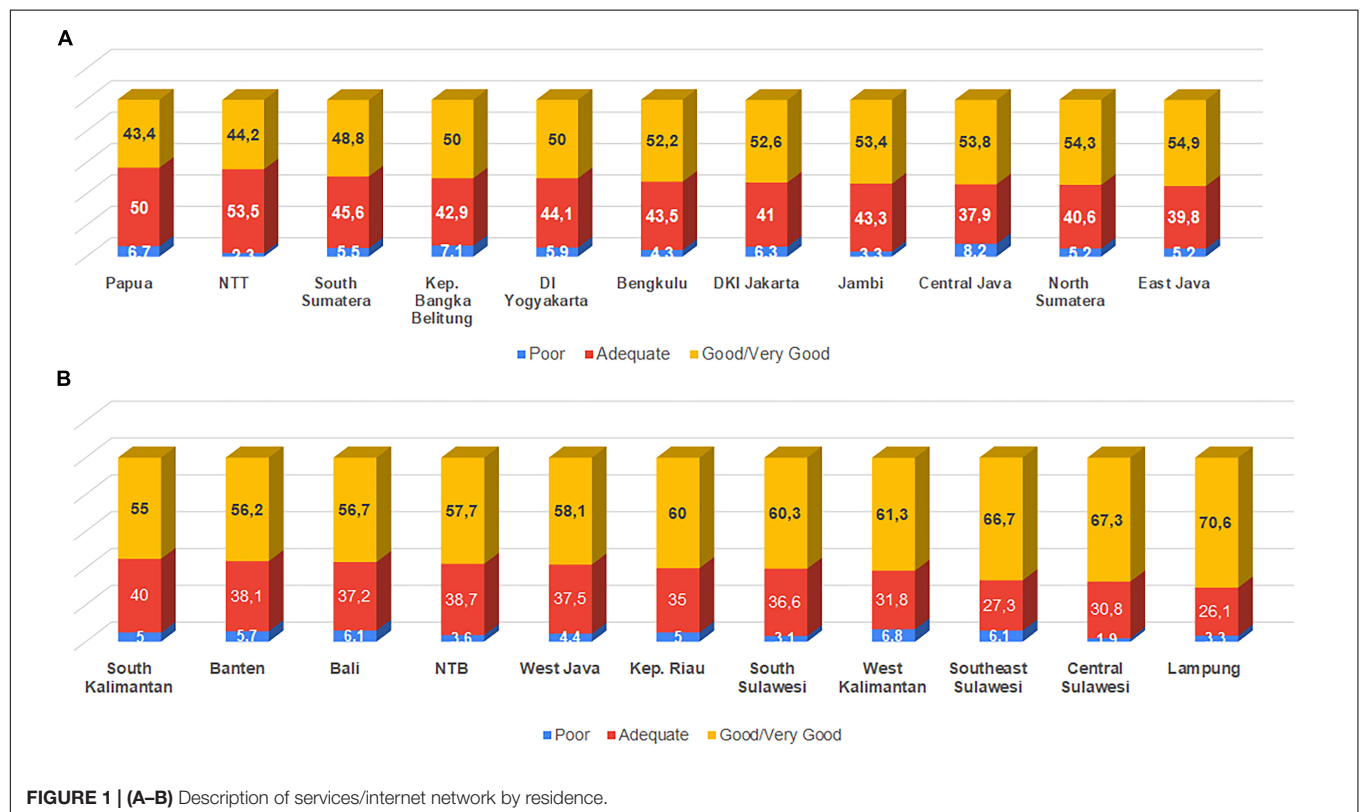
FIGURE 1 | (A–B) Description of services/internet network by residence.

TABLE 8 | Overview of Mental Health during a pandemic by year of education.

Worrying too much about different things?	Total n (%)	Year 1 n (%)	Year 2–4 n (%)	5th year or more n (%)	p-value
Not at all	3,725 (46.9)	732 (49.1)	1,986 (47.2)	1,007 (44.7)	0.120*
A few days	3,040 (38.2)	553 (37.1)	1,613 (38.3)	874 (38.8)	
More than half	768 (9.7)	133 (8.9)	391 (9.3)	244 (10.8)	
Almost every day	416 (5.2)	74 (5.0)	216 (5.1)	126 (5.6)	
Feeling sad, depressed or hopeless		**Year 1**	**Year 2–4**	**5th year or more**	**p-value**
Not at all	4,719 (46.9)	918 (61.5)	2,526 (60.1)	1,275 (56.6)	0.003*
A few days	2,223 (28)	405 (27.1)	1,159 (27.6)	659 (29.3)	
More than half	642 (8.1)	110 (7.4)	339 (8.1)	193 (8.6)	
Almost every day	365 (4.6)	59 (4.0)	182 (4.3)	124 (5.5)	

*Chi-square test.

interfered with their ability to develop the skills needed to prepare for residency (61.4%) (Harries et al., 2021).

One of the challenges in medical school is the high cost during the education process. The impact of the pandemic will undoubtedly be affected by the student's financial support system. Our study found that one-third of the respondents (28.1%) were experiencing financial problems, and 2.1% of students suspended educational programs due to financial problems. In line with other studies, in Pakistan, nearly half of the medical students (50.6%) have been affected regarding the financial aspects (Seetan et al., 2021). While the study of Al-Husban et al. (2021) showed that financial influence was a significant aspect in around 53% of students and 34% of students could not pay the university fees due to the pandemic in Jordanian.

Another impact of the pandemic is the delay of the education process, especially in the clinical phase. Almost half of the respondents stated that they experienced delays in the clinical education process. In their study, Sani et al. (2020) showed that the pandemic's immense impact on clinical phase students, the competence of students' clinical skills could decrease because they no longer have access to patients and simulation models under supervision. Therefore, students will require costly and time-consuming training after returning to the clinical environment to regain the expected level of competence and opportunities lost due to the pandemic can cause anxiety over career advancement (Sani et al., 2020).

This study also found that around 4% of students are sick, self-isolation and taking care of sick families. Bani Hani et al. (2021), in their study, reported that among 1,830 participants, 237 students (13%) tested positive for COVID-19. These include 15.2% of clinical students and 11.2% of pre-clinical students. These results support the hypothesis of higher COVID-19 incidence in clinical students than pre-clinical students (Bani Hani et al., 2021).

Some students said the pandemic had influenced their interests and future career plans, such as their interest in public

health and infection. The severity of anxiety symptoms is linked to a decrease in the desire to work in the medical specialty of respiratory and infectious diseases, according to a study by Deng et al. (2021). Psychological issues and job satisfaction appear to be separate factors that influence medical careers and specialties. According to a study by Byrnes et al. (2020), about one-fifth of medical students surveyed, believe that the COVID-19 pandemic will impact their choice of specialization. Many of them expressed concern about not being able to explore the specialty or obtain letters of recommendation (Byrnes et al., 2020). Meanwhile, a study of 10,433 medical students from 257 medical schools in Brazil found that more than half of the respondents were concerned about being infected with COVID-19 (Tempski et al., 2021).

Furthermore, the pandemic situation has had a significant impact on the future competencies required of the medical workforce in the 21st century. In addition to professional competence, care for patients, and sustainable personal accountability, new competencies better suited to address current health challenges must be embraced (Rose, 2020). Medical schools should begin to restructure their curricula to better prepare doctors as an essential element for the future workforce.

The Medical Student's Attitude

Our study reported that only 37% of the students agree/strongly agree that e-learning is a possible substitute for standard medical education, which means that more than half of respondents think studying medicine is quite tricky if e-learning were to replace traditional methods. In line with Ibrahim et al.'s study, most medical students agree that some disciplines or materials (as clinical teaching) are not suitable for e-learning and clinical skills are the most challenging learning process (Ibrahim et al., 2021). However, there is no doubt that e-learning is becoming one of the teaching methods that most likely used by providers of education with all its limitations, for that reason the clinical educators are expected to redesign the curricula core through a strategy of distance learning that guided by the faculty involving didactic teaching, case studies, and, in some cases, participation of inpatient and outpatient video conferences. Pedagogical principles of education based on competency should be quickly operationalized to enable schools to shorten secretariat blocks in terms of traditional time-bound without lowering the performance standards (Lucey et al., 2018). The data of this study also shows that more than half of the students (61%) agree and strongly agree that e-learning can be used for clinical aspects of medical sciences. It is necessary to emphasize the importance of psychomotor skills in clinical education. In the midst of a pandemic, several things can be done, for example, to use an online platform to present a review of the patient's history, findings from the physical examination, results of investigations, and proposed management plans. This visual interface will simulate bedside teaching (Sam et al., 2020).

Telemedicine is a form of patient care during a pandemic. It would be beneficial if clinicians had the opportunity to treat to people with severe and chronic conditions and if the workload of physicians could be reduced, especially during an outbreak

TABLE 9 | Overview of mental health during a pandemic based on financial conditions.

Variable	Financial distress		
	Yes (2,232)	No (5,717)	p-value
	n (%)	n (%)	
Feeling sad, depressed or hopeless			0.927*
Not at all	1,315 (58.9)	3,404 (59.5)	
A few days	630 (28.2)	1,593 (27.9)	
More than half	186 (8.3)	456 (8.0)	
Almost every day	101 (4.5)	264 (4.6)	
Worrying too much about different things?			0.876*
Not at all	1,043 (46.7)	2,682 (46.9)	
A few days	846 (37.9)	2,194 (38.4)	
More than half	225 (10.1)	543 (9.5)	
Almost every day	118 (5.3)	298 (5.2)	

*Chi-square test.

(Hollander and Carr, 2020). So, in a pandemic, psychomotor skills training will include using telemedicine to communicate and perform examinations. In contrast to an in-person clinical visit, telemedicine involves a virtual visit. It can play a significant role in teaching medical students and helping them acquire clinical experience by interacting with actual patients under the supervision of attending physicians. Virtual clinical experiences may offer patients advantages, as they are provided with ease and allow for connectivity without the risk of infection transmission (Woolliscroft, 2020). Approaches like these need to be evaluated further, and more support for their implementation in medical schools is needed.

In contrast to responses toward e-learning, our study found that more than half (71.4%) of respondents agree/strongly agree that e-testing can replace traditional testing methods in medical schools. As with e-learning, internet connection affects e-testing success; according to Ibrahim's research, low internet quality affects students' exams (Ibrahim et al., 2021). According to research conducted in the United Kingdom, the COVID-19 pandemic has a significant impact on OSCE, written examinations, and student mentoring. The majority of students believe that action is required to change the curriculum during the pandemic (Choi et al., 2020). In these circumstances, institutions must be aware of the uncertainty of timing and new test methods, which can put students under stress. The testing agency's clear and consistent communication can help to alleviate anxiety.

In this study, it was found that most students (69.1%) agreed/strongly agreed that they could help in hospitals during the pandemic. However, the risk of being infected with COVID-19 has caused many medical schools to postpone clinical education rotations, though some do continue conducting clinical rotations but restrict students to non-red zone areas of the hospital. A study in Brazil reported that most students were concerned about contracting COVID-19 (Tempski et al., 2021). The Association of American Medical Colleges and the Liaison Committee on Medical Education recommend suspending medical school rotations, as continued involvement of medical students may pose a risk of transmission of infection, which may have a major impact on patient care, especially considering the lack of personal protective equipment (Menon et al., 2020). In Indonesia itself, the Ministry of Education of Culture issued a circular letter of online learning and *work from home* to prevent the spread of Covid-19 (Ministry of Education and Culture Republic of Indonesia, 2020b).

The Medical Student's Practice
The Educational Process During the COVID-19 Pandemic

Our research shows that most students continued their education through online learning. Although the learning method was switched to e-learning, one-third of respondents stated they had postponed preclinical learning activities, and almost half had postponed clinical activities. The delay was caused, in part, by a lack of treatment, vaccines, and several management procedures for infected students at the start of the pandemic. Preclinical

students, whose learning activities are dominated by classroom learning (lecturer-based), experienced fewer delays than students in the clinical stage (Rose, 2020; Papapanou et al., 2021).

According to other studies, the pandemic heavily limited the clinical learning experience for medical students (Kaul et al., 2021). Several factors contributed to the decrease in teaching materials, including the transition from traditional health services to telemedicine, the policy of limiting surgeries to emergency cases, and the limitation of clinical supervisors' practice hours (Rose, 2020). Students' participation in direct patient care is limited by a number of other essential factors. Some institutions have to limit the number of team members who enter patient rooms to reduce the possibility of transmission to health workers and save on Personal Protective Equipment (PPE) usage.

Because of the virus's ease of spread, medical schools have become wary of involving students in the care of patients with or who are suspected of having COVID-19. The decline in the number of patients seeking treatment for conditions other than COVID-19 further complicates matters (Catherine and Lucey, 2020). Naturally, policies regarding student activities in hospitals will differ from one medical faculty to the next. Different policies are evident in different countries; for example, Italy, Ireland, and the United Kingdom engaged their students as health care workers earlier, whereas students in Canada were withdrawn from clinical assignments (Cole, 2020; CTV News, 2020; O'Brien, 2020). In the United States, some medical schools graduate students earlier. Clinical students' differing reactions to the condition are, of course, dependent on various factors, including parental permission. According to research conducted in the United Kingdom, students agreed that assisting in hospitals during an outbreak would be a valuable learning opportunity (Choi et al., 2020).

During the pandemic, each faculty will prepare graduates on time and according to standards every year. Hence, each medical faculty needs to enhance classrooms to support virtual online learning- which is being explored as a critical thinking and communication skills exercise in a simulated clinical experience. According to other studies, nearly 60% of people believe that online learning can adapt to limited time better than classroom learning (Ibrahim et al., 2021).

In this pandemic, students play a critical role, particularly in disseminating COVID-related information. Students could be a source of information for friends and family. According to Kaul's research, students could contribute to the service in meaningful ways in non-clinical roles (Kaul et al., 2021). In Indonesia, medical student activities related to COVID-19 include student volunteer activities. Students are assigned to handle preventive and promotional programs through communication, information dissemination, and education to the general public. Student volunteers can assist the government in contact tracing, call center services at the central and regional levels, and in COVID-19 service centers (Ministry of Education and Culture Republic of Indonesia, 2020a).

This pandemic situation can motivate medical students to volunteer, help with patient education, contact tracing, mental health assessments, and support their communities during this

trying time (Wayne et al., 2020). Moreover, these activities may improve their collaboration and leadership skills to better prepare them for successful patient care, interprofessional multidisciplinary practice, and advance their analytical abilities (Alsoufi et al., 2020).

Nevertheless, students must maintain their focus on completing their education in accordance with the study period. Mentors play a crucial role in providing guidance and support during these unprecedented times (O'Byrne et al., 2020). Students can also be encouraged to participate in non-clinical activities such as research and community service, examples of indirect (Kaul et al., 2021).

Medical Students as a Source of Information and the Role of Social Media

Medical students was found to be a source of information and advice for 97% of friends and 56.9% of family in this study. It can be said that medical students play an important role in distributing cutting-edge resources for public health, particularly in the midst of this pandemic, which is characterized by misinformation and extremely high rates of health hoaxes (Nasir et al., 2020).

Instagram is more widely used than other social media platforms, such as Facebook. Hence moving forward, all medical faculties can communicate with students on this same platform and learn how students communicate and participate in public education. Social media platforms like Facebook, Twitter, Instagram, YouTube, WhatsApp, and Podcasts have distinct communication capabilities that can be used for a variety of educational purposes in both formal and informal educational settings. Doctors and institutions must adapt to incorporate social media platforms into medical education (Katz and Nandi, 2021).

Lugito's research shows that respondents in the range of age 17–56 years. The three most frequent social media platforms used by participants were Instagram, WhatsApp, and YouTube. Social media exposure was associated with less likelihood to suffer from severe-extremely severe depression, mild-moderate, and severe-extremely severe anxiety, mild-moderate stress. Thus, medical professionals and government officials can use social media to disseminate information about COVID-19 to generate positive psychological effects (Lugito et al., 2021).

Evaluation of Medical Students' Use of E-Learning

Our study shows that the implementation of e-learning is quite good. Most students use the internet in the learning process, including downloading materials, sharing learning materials, studying with friends or groups, and utilizing internet facilities to attend medical-related training. The Nambiar study conveys essential points that must be considered for teacher and student satisfaction in the implementation of e-learning, such as quality and punctual interactions between students and lecturers, availability of technical support, structured online class modules, and modifications to accommodate practical classroom implementation (Nambiar, 2020).

Mental Health

This study found the prevalence of mental health disorders that can lead to anxiety and depression. Many students (54.7%) reported anxiety symptoms about being exposed to SARS-CoV-2 during their clinical training, while 60.7% were worried about viral transmission in the community. Data on the prevalence of mental health disorders vary widely.

Several studies reported an increase in depressive symptoms among students. Depression symptoms were prevalent in 66.7% of pre-pandemic students (95% CI = 65.3–68.1) and 81% of students during the pandemic (Campos et al., 2021). A Study by Agiananda and Lukman (2021) showed that 30% of medical students were psychologically distressed (21.2% affected by depression and 24.9% by anxiety). Studies in Indonesia showed that depression, anxiety, and stress are commonly found in Indonesia during the COVID-19 pandemic (Argo et al., 2021). Research in Libya showed that high levels of anxiety and depression were found among medical students, of whom 31.3% indicated a high likelihood of experiencing depressive symptoms, and 10.5% likely experienced anxiety (Alsoufi et al., 2020). Another study among Chinese college students, 0.9% suffered from severe anxiety and 2.7% experienced moderate anxiety symptoms during the COVID-19 outbreak (Cao et al., 2020) while a study in Jordan reported that COVID-19 affected students' physical health, study and social relationships. In fact, almost half of respondents reported experiencing mental health disorders (Seetan et al., 2021).

Many factors cause mental disorders during the pandemic. There are high morbidity and mortality rates, increased work commitments with a significant reduction in recovery time, impact of illness on coworkers and family, economic stress, social isolation, and social stress, among other reasons (Kaul et al., 2021). Moreover, anxiety, fear, and depression have been reported among medical students due to ineffective learning as a result of the abrupt switch to online learning (Nishimura et al., 2021). Another study by telephone interview found that students were bored with online learning after the first 2 weeks of studying from home, that research subjects with low incomes had to buy quotas to be able to participate in online learning, and that mood changes occur when there were too many assignments which were considered ineffective (Irawan et al., 2020).

Worries and sadness/depression increased with the length of the study period in our study. This can be caused by students who have a longer study period being concerned that they will not be able to complete their studies in the time allotted, or worse, they will be dropped from school. Final-year students face various concerns as they are required to interact with various people, including meeting peer groups, mentors, and patients during the education process and preparing for national exams and post-graduation job opportunities. These circumstances may increase their exposure to the SAR-COV-2 virus, increasing their concern of infection.

Although most preclinical students do not have complaints of anxiety and depression, there is a small proportion who are worried about the current condition. This is in line with the findings of Halperin et al.'s (2021) study, which reported that student anxiety at the beginning of pandemic for the

preclinical level was more significant due to the relocation of learning methods, uncertainty over the date of the exam, at-home distraction, and lack of experience in the medical faculty. Meanwhile, students at the profession (clinical) stage have a decreased level of concern due to the imposition of online learning methods that can reduce the frequency of exposure to the virus (Halperin et al., 2021). Other studies have shown that those concerned about the shift to online education are more likely to experience generalized anxiety and depression (Nishimura et al., 2021).

In this study, there was no relationship between financial problems and mental health. This shows that mental health problems are caused by many factors, not only because of financial issues. However, in general, the financial impact of the pandemic is an important issue that must be considered because the economic status at the country and the individual level was found to be significantly affected by the outbreak (Kernan, 2019). Although the cause of mental health problems is multifactorial, it is crucial to consider the pandemic's significant effect on the loss or reduction of income sources (Seetan et al., 2021).

LIMITATION OF STUDY

Although the study involved participants from 49 medical faculties (from 90 faculties) in Indonesia, it has not been able to describe the overall situation of students at other medical faculties, especially those from state/government medical faculties or different provinces.

CONCLUSION

The infrastructure and competency of its users are required for E-learning to be successful. The majority of medical students believe that e-learning can be adopted in Indonesia and that their capacity to use electronic devices is good. However, access to the internet remains a problem. Medical students are also important players in this epidemic, especially when it comes to sharing COVID-related information. On the other side, the pandemic has disrupted the education process and mental health, with fears of being infected with SARS-CoV-2, the loss of opportunities

to apply for specialty training, and the potential for increased financial difficulties among medical students. Our findings can be used to assess the current educational process in medical schools and maximize e-learning as an alternative means of preparing doctors for the future.

DATA AVAILABILITY STATEMENT

All relevant datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

ETHICS STATEMENT

Ethical approval was obtained from the Ethics Committee at Atma Jaya Catholic University of Indonesia (No. 14/06/KEP-FKIKUAJ/2021). The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

YT, WSS, and MW designed and directed the project. YT and PAP were involved in planning and supervised the work. IS and FY performed the analysis and designed the Table. YT, PAP, ABSD, RW, DAd, PKS, EB, DAn, DQA, KS, IWD, YA, TP, AT, WP, AK, AW, MS, MM, SY, Rahayu, SS, BR, SMPL, AP, DALD, MD, TOP, FMR, ZPM, SWH, NH, WS, WD, DP, LC, SL, RT, GDTT, IAT, AWS, FA, SAL, NST, GP, RP, MA, RA, JI, Handayani, VP, MT, and FK drafted the manuscript. YT, IS, FY, PAP, and FK aided in interpreting the results and worked on the manuscript. All authors discussed the results and commented on the manuscript.

ACKNOWLEDGMENTS

REFERENCES

Agiananda, F., and Lukman, P. (2021). *Psychological Well-Being Of Medical Students and Health-Care Workers in COVID-19 Pandemic*. Available online at: https://imeri.fk.ui.ac.id/wp-content/uploads/2019/03/Psychological-Wellbeing-of-Med-Students-HCWs-in-Covid19-Pandemic_FA-PR-2.pdf (accessed December 12, 2021).

Al-Balas, M., Al-Balas, H. I., Jaber, H. M., Obeidat, K., Al-Balas, H., Aborajooh, E. A., et al. (2020). Correction to: distance learning in clinical medical education amid COVID-19 pandemic in Jordan: current situation, challenges, and perspectives. *BMC Med. Educ.* 20:513. doi: 10.1186/s12909-020-02428-3

Al-Husban, N., Alkhayat, A., Aljweesri, M., Alharbi, R., Aljazzaf, Z., Al-Husban, N., et al. (2021). Effects of COVID-19 pandemic on medical students in Jordanian universities: a multi-center cross-sectional study. *Ann. Med. Surg.* 67:102466. doi: 10.1016/j.amsu.2021.102466

Alsoufi, A., Alsuyihili, A., Msherghi, A., Elhadi, A., Atiyah, H., Ashini, A., et al. (2020). Impact of the COVID-19 pandemic on medical education: medical students' knowledge, attitudes, and practices regarding electronic learning. *PLoS One* 15:e0242905. doi: 10.1371/journal.pone.0242905

Argo, T. M., Kurniawan, A., Liem, J. A., Sugianto, J. O., Michael, J., Victoria, N., et al. (2021). Profile and factors associated with depression, anxiety, and stress in indonesian people during COVID-19 pandemic. *Medicinus* 8, 131–140.

Badan Pusat Statistik (BPS) (2019). *Berita Resmi Statistik Badan Pusat Statistik*. Available online at: https://papua.bps.go.id/pressrelease/2018/05/07/336/indeks-pembangunan-manusia-provinsi-papua-tahun-2017.html (accessed December 12, 2021).

Bani Hani, A., Alaridah, N., Abu Abeeleh, M., Shatarat, A., Rayyan, R., Kamal, A., et al. (2021). Medical students and risk of COVID-19 infection: a descriptive cross-sectional study from the University of Jordan. *Ann. Med. Surg.* 70:102775. doi: 10.1016/j.amsu.2021.102775

Browning, M. H. E. M., Larson, L. R., Sharaievska, I., Rigolon, A., McAnirlin, O., Mullenbach, L., et al. (2021). Psychological impacts from COVID-19 among university students: risk factors across seven states in the United States. *PLoS One* 16:e0245327. doi: 10.1371/journal.pone.0245327

Byrnes, Y. M., Civantos, A. M., Go, B. C., McWilliams, T. L., and Rajasekaran, K. (2020). Effect of the COVID-19 pandemic on medical student career perceptions: a national survey study. *Med. Educ. Online* 25:1798088. doi: 10.1080/10872981.2020.1798088

Campos, J. A. D. B., Campos, L. A., Bueno, D. B., and Gonzalez, M. B. (2021). Emotions and mood swings of pharmacy students in the context of the coronavirus disease of 2019 pandemic. *Curr. Pharm. Teach. Learn.* 13, 635–642. doi: 10.1016/j.cptl.2021.01.034

Cao, W., Fang, Z., Hou, G., Han, M., Xu, X., Dong, J., et al. (2020). The psychological impact of the COVID-19 epidemic on college students in China. *Psychiatry Res.* 287:112934. doi: 10.1016/j.psychres.2020.112934

Catherine, R., and Lucey, S. C. J. (2020). The transformational effects of COVID-19 on medical education. *J. Am. Med. Assoc.* 324, 1033–1034. doi: 10.1001/jama.2020.14136

Choi, B., Jegatheeswaran, L., Minocha, A., Alhilani, M., Nakhoul, M., and Ernest, M. (2020). The impact of the COVID-19 pandemic on final year medical students in the United Kingdom: a national survey. *BMC Med. Educ.* 20:206. doi: 10.1186/s12909-020-02117-1

CNN Indonesia (2020). *Kominfo Ungkap Masalah Internet di Indonesia*. Available online at: https://www.cnnindonesia.com/teknologi/20201215131630-213-582359/kominfo-ungkap-masalah-internet-di-indonesia (accessed July 12, 2021).

Cole, B. (2020). 10,000 Med School Graduates in Italy Skip Final Exam, Get Sent Directly into Health Service to Help Fight COVID-19 Newsweek. Available online at: https://www.newsweek.com/italy-coronaviruscovid-19-medical-students-1492996 (accessed December 15, 2021).

CTV News (2020). *Medical Students Volunteer on the Pandemic Front Lines After Classes Cancelled*. Toronto: CTV News.

Daroedono, E., Siagian, F. E., Alfarabi, M., Cing, J. M., Arodes, E. S., Sirait, R. H., et al. (2020). The impact of COVID-19 on medical education: our students perception on the practice of long distance learning. *Int. J. Commun. Med. Public Health* 7:2790. doi: 10.1080/10872981.2021.1919042

Deng, J., Que, J., Wu, S., Zhang, Y., Liu, J., Chen, S., et al. (2021). Effects of COVID-19 on career and specialty choices among Chinese medical students. *Med. Educ. Online* 26:1913785. doi: 10.1080/10872981.2021.1913785

Duraku, Z. L., and Hoxha, L. (2020). *The Impact of COVID-19 on Higher Education: A Study of Interaction Among Students' Mental Health, Attitudes Toward Online Learning, Study Skills, and Changes in Students' Life*. 1–18. Available online at: https://www.researchgate.net/publication/341599684_The_impact_of_COVID-19_on_higher_education_A_study_of_interaction_among_students'_mental_health_attitudes_toward_online_learning_study_skills_and_changes_in_students'_life (accessed December 12, 2021).

Frehywot, S., Vovides, Y., Talib, Z., Mikhail, N., Ross, H., Wohltjen, H., et al. (2013). E-learning in medical education in resource constrained low- and middle-income countries. *Hum. Resour. Health* 11:4. doi: 10.1186/1478-4491-11-4

Halperin, S. J., Henderson, M. N., Prenner, S., and Grauer, J. N. (2021). Prevalence of anxiety and depression among medical students during the Covid-19 pandemic: a cross-sectional study. *J. Med. Educ. Curric. Dev.* 8:238212052199115. doi: 10.1177/2382120521991150

Harries, J. A., Lee, C., Jones, L., Rodriguez, R. M., Davis, J. A., Boysen-Osborn, M., et al. (2021). Effects of the COVID-19 pandemic on medical students: a multicenter quantitative study. *BMC Med. Educ.* 21:14. doi: 10.1186/s12909-020-02462-1

Hollander, J. E., and Carr, B. G. (2020). Virtually Perfect? Telemedicine for Covid-19. *N. Engl. J. Med.* 382, 1677–1679.

Ibrahim, N. K., Al Raddadi, R., AlDarmasi, M., Al Ghamdi, A., Gaddoury, M., AlBar, H. M., et al. (2021). Medical students' acceptance and perceptions of e-learning during the Covid-19 closure time in King Abdulaziz University, Jeddah. *J. Infect. Public Health* 14, 17–23. doi: 10.1016/j.jiph.2020.11.007

Indonesia Survey Center [ISC] (2020). *Laporan Survei internet APJII*. Available online at: https://apjii.or.id/survei. (accessed July 12, 2021).

Irawan, A. W., Dwisona, D., and Lestari, M. (2020). Psychological Impacts of Students on Online Learning During the Pandemic COVID-19. *Konseli J. Bimbing dan Konseling* 7, 53–60.

Kapasia, N., Paul, P., Roy, A., Saha, J., Zaveri, A., and Mallick, R. (2020). Impact of lockdown on learning status of undergraduate and postgraduate students during COVID-19 pandemic in West Bengal, India. *Child. Youth Serv. Rev.* 16:105194. doi: 10.1016/j.childyouth.2020.105194

Katz, M., and Nandi, N. (2021). Social media and medical education in the context of the COVID-19 pandemic: scoping review. *JMIR Med. Educ.* 7:e25892. doi: 10.2196/25892

Kaul, V., Gallo de Moraes, A., Khateeb, D., Greenstein, Y., Winter, G., Chae, J. M., et al. (2021). Medical Education During the COVID-19 Pandemic. *Chest* 159, 1949–1960. doi: 10.1016/j.chest.2020.12.026

Kecojevic, A., Basch, C. H., Sullivan, M., and Davi, N. K. (2020). The impact of the COVID-19 epidemic on mental health of undergraduate students in New Jersey, cross-sectional study. *PLoS One* 15:e0239696. doi: 10.1371/journal.pone.0239696

Kelly, K., Hwei, L. R. Y., and Octavius, G. S. (2020). Coronavirus outbreaks including COVID-19 and impacts on medical education: a systematic review. *J. Commun. Empower. Heal.* 3:130.

Kernan, W. (2019). Health-related impediments to learning among dental and oral surgery students. *J. Prev. Interv. Commun.* 47, 32–44. doi: 10.1080/10852352.2018.1547307

Kim, J. W., Myung, S. J., Yoon, H. B., Moon, S. H., Ryu, H., and Yim, J. J. (2020). How medical education survives and evolves during COVID-19: our experience and future direction. *PLoS One* 15:e0243958. doi: 10.1371/journal.pone.0243958

Kroenke, K., Spitzer, R. L., and Williams, J. B. W. (2003). The patient health questionnaire-2: validity of a two-item depression screener. *Med. Care* 41, 1284–1292. doi: 10.1097/01.MLR.0000093487.78664.3C

Lucey, C. R., Thibault, G. E., and Ten Cate, O. (2018). Competency-based, time-variable education in the health professions: crossroads. *Acad. Med.* 93, S1–S5. doi: 10.1097/ACM.0000000000002080

Lugito, N. P. H., Damay, V., Chyntya, H., and Sugianto, N. (2021). Social media exposure and mental health problems during coronavirus disease 2019 pandemic in Indonesia. *J. Educ. Health Promot.* 10:200. doi: 10.4103/jehp.jehp_1032_20

Maulana, H. A. (2021). Psychological impact of online learning during the COVID-19 pandemic: a case study on vocational higher education. *Indones. J. Learn. Educ. Couns.* 3, 130–139.

Medico-19 Research Group Fakultas Kedokteran Universitas Indonesia (2021). *Policy Brief Dari Edukasi Hingga Vaksinasi (in Bahasa)*. Jakarta: Fakultas Kedokteran Universitas Indonesia.

Menon, A., Klein, E. J., Kollars, K., and Kleinhenz, A. L. W. (2020). Medical students are not essential workers: examining institutional responsibility during the COVID-19 pandemic. *Acad. Med.* 95, 1149–1151. doi: 10.1097/ACM.0000000000003478

Ministry of Education and Culture Republic of Indonesia (2020b). *Online Learning and Working from Home to Prevent the Spread of Covid-19 (in Bahasa)*. Available online at: https://www.kemdikbud.go.id/main/blog/2020/03/se-mendikbud-pembelajaran-secara-daring-dan-bekerja-dari-rumah-untuk-mencegah-penyebaran-covid19 (accessed July 7, 2020).

Ministry of Education and Culture Republic of Indonesia (2020a). *In the Initial Stage, the Ministry of Education and Culture Gets the Support of 15,000 Student Volunteers to Help Deal with the Covid-19 Pandemic (in Bahasa)*. Available online at: https://www.kemdikbud.go.id/main/blog/2020/03/tahap-awal-kemendikbud-raih-dukungan-15000-relawan-mahasiswa-bantu-tangani-pandemi-covid19 (accessed July 12, 2021).

Ministry of Education and Culture Republic of Indonesia (2021). *Internet Data Quota Assistance 2021 (Bantuan Kuota Data Internet 2021)*. Available online at: https://www.lspr.edu/info-internet-data-quota-assistance-2021-by-ministry-of-education-and-culture/ (accessed July 12, 2021).

Ministry of Health of Republic Indonesia (2019). *Indonesia Health Profile 2018*. Jakarta: Ministry of Health of Republic Indonesia.

Nambiar, D. (2020). The impact of online learning during COVID-19: students' and teachers' perspective. *Int. J. Indian Psychol.* 8, 783–793.

Nasir, N. M., Baequni, B., and Nurmansyah, M. I. (2020). Misinformation Related To Covid-19 in Indonesia. *J. Adm. Kesehat Indones.* 8:51.

Nishimura, Y., Ochi, K., Tokumasu, K., Obika, M., Hagiya, H., Kataoka, H., et al. (2021). Impact of the COVID-19 Pandemic on the psychological distress of medical students in Japan: cross-sectional survey study. *J. Med. Internet Res.* 23, 1–14. doi: 10.2196/25232

O'Brien, C. (2020). *Coronavirus: Hundreds of Medicine Students Fast-tracked into Fight Against Covid-19*. Available online at: https://www.irishtimes.com/news/education/coronavirushundreds-of-medicine-students-fast-tracked-into-fight-againstcovid-19-1.4205676 (accessed December 13, 2021).

O'Byrne, L., Gavin, B., and McNicholas, F. (2020). Medical students and COVID-19: the need for pandemic preparedness. *J. Med. Ethics* 46, 623–626. doi: 10.1136/medethics-2020-106353

Onyema, E. M. (2019). Integration of Emerging Technologies in Teaching and Learning Process in Nigeria: the challenges. *Cent. Asian J. Math Theory Comput. Sci.* 1:1.

Onyema, E. M., Obafemi, F., Sen, S., and Sharma, A. (2020). Impact of Coronavirus Pandemic on Education. *J. Educ. Pract.* 11, 108–21.

Papapanou, M., Routsi, E., Tsamakis, K., Fotis, L., Marinos, G., Lidoriki, I., et al. (2021). Medical education challenges and innovations during COVID-19 pandemic. *Postgrad. Med. J.* [Epub Online ahead of print]. doi: 10.1136/postgradmedj-2021-140032

Rose, S. (2020). Medical Student Education in the Time of COVID-19. *J. Am. Med. Assoc.* 323, 2131–2132.

Sam, A. H., Millar, K. R., and Lupton, M. (2020). Digital clinical placement for medical students in response to COVID-19. *Acad. Med.* 95:1126. doi: 10.1097/ACM.0000000000003431

Sani, I., Hamza, Y., Chedid, Y., Amalendran, J., and Hamza, N. (2020). Understanding the consequence of COVID-19 on undergraduate medical education: medical students' perspective. *Ann. Med. Surg.* 58, 117–119. doi: 10.1016/j.amsu.2020.08.045

Seetan, K., Al-Zubi, M., Rubbai, Y., Athamneh, M., Khamees, A., and Radaideh, T. (2021). Impact of COVID-19 on medical students' mental wellbeing in Jordan. *PLoS One* 16:e0253295. doi: 10.1371/journal.pone.0253295

Spitzer, R. L., Kroenke, K., Williams, J. W., and Löwe, B. (2006). A brief measure for assessing generalized anxiety disorder: the GAD-7. *Arch. Intern. Med.* 166, 1092–1097. doi: 10.1001/archinte.166.10.1092

Tempski, P., Arantes-Costa, F. M., Kobayasi, R., Siqueira, M. A. M., Torsani, M. B., Amaro, B. Q. R. C., et al. (2021). Medical students' perceptions and motivations during the COVID-19 pandemic. *PLoS One* 16:e0248627. doi: 10.1371/journal.pone.0248627

Wayne, D. B., Green, M., and Neilson, E. G. (2020). Medical education in the time of COVID-19. *Sci. Adv.* 6:eabc7110. doi: 10.1126/sciadv.abc7110

Wenjun, C., Ziwei, F., Guoqiang, H., Mei, H., Xinrong, X., Jiaxin, D., et al. (2020). The psychological impact of the COVID-19 epidemic on college students in China. *Psychiatry Res.* 287:112934.

Woolliscroft, J. O. (2020). Innovation in response to the COVID-19 pandemic crisis. *Acad. Med.* 95, 1140–1142.

Testing and Validating a Faculty Blended Learning Adoption Model

Ahmed Antwi-Boampong*

Center for Communication, Media and Information Technologies, Department of Electronic Systems, Aalborg University, Aalborg, Denmark

Faculty members are crucial to Blended Learning's success in higher education. Despite substantial research into the elements that drive faculty adoption of BL, few have developed a model to explain how these factors combine and influence faculty intentions to teach in this mode. This study used data collected from 207 professors from 18 universities across Africa, the United States, Europe, and the Middle East to test and validate a Faculty Blended Learning Adoption Model which was derived from a Grounded Theory study. Four model constructs (institutional hygiene readiness, student BL disposition, faculty technology ready, and Pedagogy Technology Fit for BL) mediated by motivation were tested to predict faculty Blended Learning adoption using structural equation modeling. The results demonstrated an excellent model fit, with three of the six hypotheses in this study being supported. Faculty desire to utilize BL was found to be influenced by faculty technology readiness and task technology fit for BL, but not by institutional hygiene readiness or student BL disposition. This research presents a useful model for university administrators to use in their BL implementations. A thorough understanding of this model can assist decision-makers in identifying the factors that influence future faculty acceptance or resistance to blended learning, as well as helping them in enhancing acceptance and usage.

Keywords: blended learning, technology adoption, technology readiness, institutional readiness, motivation, pedagogy

INTRODUCTION

The difficulty that faculty members have had in adopting Blended Learning (BL) in Higher Education Institutions (HEIs) has been thoroughly researched for many years (Callo and Yazon, 2020). In Ghana and elsewhere (Adarkwah, 2021), it is frequently asserted that BL has the ability to change academia and become the new normal for teaching and learning (Blieck et al., 2020). While this is so, faculty members are very slow in adopting BL implemented within the universities

(Martin et al., 2019b). The key role faculty members play in the failure or successes in its implementation is well documented (Martin et al., 2019b). It is this concern over the failure of faculty members to adopt BL for teaching and learning that has generated the copious literature on the challenges of BL adoption (Aboagye et al., 2020). The ability to thrive in teaching in BL mode environment requires instructors to go through a learning curve, thus simply being a great teacher in a traditional face-to-face classroom is not enough (Albrahim, 2020). Only a few teacher education programs focus on the skills, methodologies, and techniques required for online teaching (Archambault and Larson, 2015; Rahmawati et al., 2021). As a result, many faculty members lack both theoretical and practical understanding of teaching and learning online (Adiyarta et al., 2018).

For this article, the journey to understand faculty BL adoption begun when the management of a public institution X in Ghana decided to update faculty teaching requirements to include having the competencies to teach in blended mode through acquiring BL certification at the university's center for online learning and teaching. This led to an inquiry to investigate the barriers of faculty BL adoption after a management report detailed faculty reluctance to teach online despite considerable investment made in the acquisition of a learning management system (Moodle) and the retooling of the curriculum to accommodate BL. Additionally, the author wondered what students' experience of BL was in the wake of the low faculty adoption, and thus conducted a GT using the experiences of the faculty members teaching BL to develop a faculty blended learning adoption model. Whiles most traditional HEI programs require an integration of technology into teaching and learning, there has been a less than commensurate effort on the part of management to ensure faculty members acquired the requisite competencies required for BL teaching and learning (Anthony Jnr, 2021). To this extent, there is minimal understanding of the elements that guide faculty preparation toward implementing a campus wide blended learning environment (Graham et al., 2019).

The purpose of this study is to test and validate the Faculty Blended Learning Adoption Model (FBLAM; Antwi-Boampong, 2020) and to explain the factors that motivate faculty toward adoption of BL. The constructs contained in this model were drawn from an exploratory Grounded Theory study Antwi-Boampong (2020) that modeled the lived experiences of faculty members' BL adoption. According to the findings, teachers' knowledge and abilities may be better understood, allowing for more targeted and customized professional development opportunities to better prepare educators for teaching in mixed contexts (Graham et al., 2019). The principal question this article asks is: what is the effect of the predictors of the constructs of FBLAM mediated by motivation on BL adoption within the HEI? The paper begins with an account of the antecedents of the FBLAM, then moves on to discuss the constructs empirically before discussing the formulation of the hypothesis. Thereafter, the methodology and the findings for the study are presented. We conclude by arguing for adopting the FBLAM as an empirically tested and validated model for BL adoption by HEIs.

LITERATURE REVIEW

To get a better understanding of the elements that impact faculty BL adoption, previous literature looked at BL research in the context of models that have shown promise in predicting faculty adoption.

Institutional Hygiene Readiness

A framework has been created to assist higher education institutions in making the move to improved blended learning. The suggested framework by Adekola et al. (2017) tackles the why (change agents), what (institutional concerns), how (organizational readiness), and who (stakeholders) of improved blended learning transitions. A successful institutional shift into improved blended learning necessitates the participation of all stakeholder groups (Adekola et al., 2017). Supportive factors, attitude, learning style, contentment, course management, and simplicity of use all positively impact learners' and academic staffs' perceptions of BL adoption. Similarly, studies show that faculty attitude toward BL adoption is influenced positively by strategy, structure, and support factors (Anthony et al., 2019). The findings support higher education institutions to plan and initiate BL policies. Anthony Jnr (2021) provides insights on BL from an institutional theory perspective. It was discovered that faculty members' adoption of BL is strongly impacted by coercive, normative, and mimetic influences. In addition, the research highlighted institutional initiatives that have an impact on BL implementation. Institutional hygiene readiness represents the preparedness of the institution toward providing an environment that is conducive enough to motivate faculty to want to use BL for teaching and learning. This is confirmed in previous research (Machado, 2007; Wong et al., 2014; Rahmawati et al., 2021). The following primary hypotheses is tested in the current study, which is based on empirical data across a variety of jurisdictions.

> H_{a1} – IHR significantly influences BL adoption.
>
> H_{a2} – IHR significantly influences BL adoption mediated by motivation.

Faculty Technology Readiness

This construct describes a set of implicit factors that are primarily related to the personal attributes of the faculty members needed as pre-requisite for BL delivery. These include the technological competences of faculty members which are requisites for instructional design and delivery of BL contents. According to Mercado (2008), Cutri and Mena (2020), and Legaspi et al. (2021) several colleges use a readiness technique to assess faculty technology readiness to teach online, however, the majority have not been properly investigated or experimentally evaluated. Only a few studies have investigated whether faculty members are ready to teach online. Junus et al. (2021) looked at how online instructors' e-learning readiness was assessed before, during, and after the course was delivered. They discovered that online instructors had a pressing need for online support desk services. Faculty members do not feel well prepared to teach online (Martin et al., 2019a,c). However, identifying competences

to equip faculty to teach online remains a priority, and by doing so, we will be able to provide recommendations on how to teach in BL mode. Callo and Yazon (2020) looked at teacher educators' readiness and preparation for, as well as their perspectives of preservice teacher preparation. Martin et al. (2019b) define *faculty readiness to teach online* "as a state of faculty preparation for online Teaching." In the context of this study, we are particularly interested in two elements of readiness: (1) faculty attitudes toward the relevance of online teaching, and (2) faculty views of their technological competence to teach online confidently. Faculty Technology-Readiness refers to an individual's readiness to make use of new technology in the course of their work (Parasuraman, 2000; Cutri and Mena, 2020). Thus, the following hypotheses are proposed:

> H_{a3} – Faculty technology readiness significantly influences BL adoption.

> H_{a4} – Faculty technology readiness significantly influences BL adoption mediated by motivation.

Student's Disposition to Accept Blended Learning

As opposed to teaching presence in non-BL situations, it is the student disposition that has a bigger effect over teaching presence in BL environments (Sangwan et al., 2021). Comparing web-based technologies to conventional classroom learning, despite their extensive use, web-based technologies still confront the difficulty of not being readily accepted when presented into a new application scenario (Adarkwah, 2021). Individual differences exist in students' dispositions and preparedness to embrace and use web-based learning tools, as well (Geng et al., 2019). During the learning situations, students' attitudes about technology-based applications reflect their level of technological preparedness (Legaspi et al., 2021). Cheon et al. (2012) discovered that college students' attitudes about mobile learning had a favorable impact on their intention to use mobile learning. In the FBLAM setting, a good attitude about using online learning resources among students will encourage faculty to teach in BL mode and achieve the desired learning outcome (Antwi-Boampong, 2020; Al-Ayed and Al-Tit, 2021).

It has already been stated that the usage of learning technologies has a variety of effects on students' learning outcomes, with some of these effects being produced by contextual and cognitive variables and others being driven by technological factors alone (Hong et al., 2014; Sangwan et al., 2021). In science education, it has been discovered that a BL atmosphere improves student attendance and learning pleasure (Tang, 2013). Students' intellectual development can also be enhanced by utilizing online course materials (Teo et al., 2019). Students' views and behaviors are influenced by a variety of factors, which is why it is important to investigate their preparedness for learning technologies as well as their impacts on their perceptions and behaviors. According to Parasuraman (2000) and Tubaishat and Lansari (2011), a measurement scale for technology readiness was developed and validated, and it consisted of 28 items that were divided

into four categories: optimism, innovativeness, discomfort, and insecurity. Parasuraman (2000) found that the Technology Readiness Index (TRI) was effective in identifying individuals who were technologically ready. Each of these four categories reflects the individual's attitude toward new technology in the context of the learning process in its whole (Parasuraman, 2000). The following hypotheses are proposed:

> H_{a5} – Student disposition to adopt BL significantly influences BL adoption.

> H_{a6} – Student disposition to adopt BL significantly influences BL adoption mediated by motivation.

Pedagogy-Technology-Fit

This construct is operationalized through dimensions of fit that consider: (1) the underpinning ontology of the domain, (2) the purpose of the task that the representation is meant to support, (3) how best to support the cognitive processes of the users of the representations, (4) users' differing needs and preferences, and (5) the tool and environment in which the representations are constructed and manipulated (Masterman and Craft, 2013). To explore the extent to which it is possible to describe all the parts of a domain being described, as well as the connections between them, for problem-solving purposes, Masterman and Craft (2013) uses the phrase "ontology-fit." Faculty technology readiness to teach online is defined as the level of faculty preparedness for online teaching because of technological advances. Specifically, in the context of this study, we will be focusing on two elements of preparedness: (1) faculty attitude on the importance of online teaching and (2) faculty competences and implicit ability to confidently teach online using technology. The hypothesized relationship of P-T-F is drawn from related literature and discussed below. The FBLAM proposes in line with similar studies (Okojie et al., 2006; Dennehy et al., 2016) that the P-T-F has a positive influence on faculty motivation to adopt BL (that is the better the pedagogy used for teaching fits or is compatible with the technology employed to deliver BL courses, the more positive the anticipation that faculty would teach in blended mode). In the context of BL, the anticipated benefits would include faculty being able to deliver courses to students more easily, quickly to improve their learning outcomes.

There have been several models in the literature developed to help organizations understand how individuals make use of technology (Susanto et al., 2020). A model for task–technology fit was created by Goodhue and Thompson (1995) to predict performance, with the idea of task–technology fit serving as a predictor. It has been studied what influence task–technology fit has on various domains by employing various elements of the Technology to Performance Chain (TPC). For the first time, McGill and Klobas (2009) used the technology to performance chain as a framework to investigate how task–technology fit affects the performance impacts of learning Management Systems (LMSs). Several findings (Fathema et al., 2015; Junus et al., 2021) offered significant evidence for the relevance of task–technology fit, which affected perceived impact on learning both directly and indirectly by the degree to which it was utilized. The role

of pedagogy–technology fit in the BL domain has not yet been thoroughly studied (Dennehy et al., 2016). As a result, given the need for thorough study into the variables that affect faculty BL adoption, determining the relevance of the PTF might be a useful construct for determining the elements that drive faculty BL adoption. Based on the empirical findings the current study tests the following principal hypotheses:

H_{a7} – PTF significantly influences BL adoption.

H_{a8} – PTF significantly influences BL adoption mediated by motivation.

Teaching Motivation

According to the findings of faculty adoption research (Martin, 2010; Reeve, 2015; Garrote and Pettersson, 2016), motivation is a critical component in both online and in-class learning environments. Teaching motivation is the process through which goal-directed action is started and sustained, and it is represented in personal involvement as well as cognitive, emotional, and behavioral engagement in learning activities (Chen and Jang, 2010; Nikou and Economides, 2017). According to Hoffman (2013) both extrinsic and intrinsic variables are associated with faculty members' desire to participate in online education in a favorable and statistically significant way. Some intrinsic variables include a faculty member's opinions about the effectiveness of online education and their desire to broaden student access to higher education opportunities (Hartnett, 2016). A faculty member's willingness to participate

in online education was found to be the most important factor in their willingness to teach online courses (Sørebø et al., 2009). Intrinsic factors, including belief in the efficacy of online education and desire to increase student access to education, were found to have the strongest impact (Hoffman, 2013). Although much educational research (Pereira and Figueiredo, 2010; Gautreau, 2011; Maldonado et al., 2011) emphasizes on motivation, the effect of pedagogy-technology-fit, students BL disposition, institutional hygiene readiness and faculty technology readiness have not been explored in the blended learning setting (Antwi-Boampong, 2020).

The FBLAM (Antwi-Boampong, 2020), as illustrated in **Figure 1**, which presents hypothesized relationships between pedagogy-technology-fit, students BL disposition, institutional hygiene readiness and faculty technology readiness in predicting faculty adoption is tested.

Table 1 presents the model constructs and descriptions that explains them.

METHODOLOGY

Design and Participants

The study used a correlational study design, which is consistent with previous studies undertaken to assess the BL adoption (Lin and Wang, 2012). MacDonald and Reid (2013) proposed a sample size determination-based chi-square for specified confidence interval at 1 degree of freedom on a population

FIGURE 1 | Faculty blended learning adoption model [adopted from Antwi-Boampong (2020)].
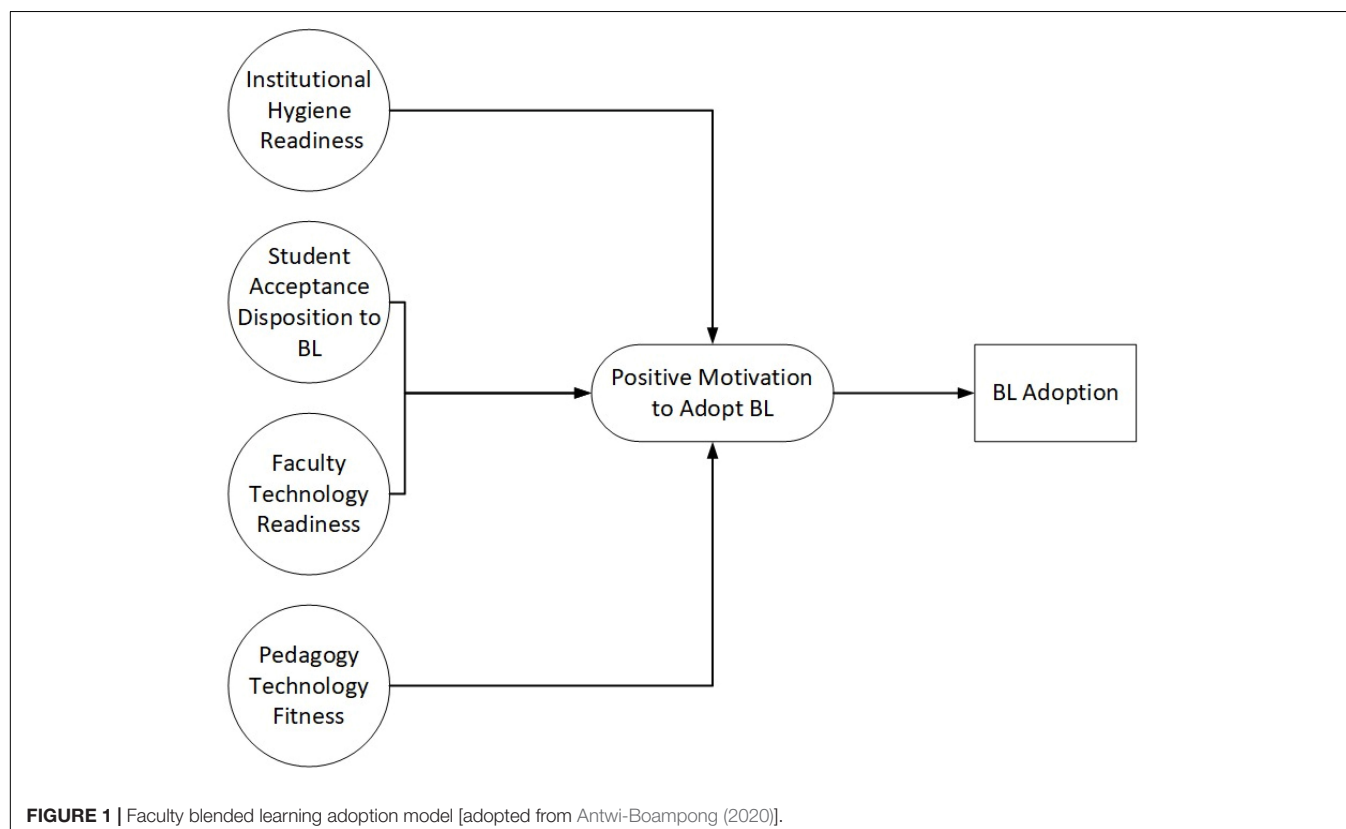
(N) of respondents. At a significance level of 5%, a closed ended questionnaire was administered to a sample of 207 from a population of 500 university lecturers and faculty administers and officers who have between 1 and 10 years' experience in BL across 19 universities in six countries (Ghana, Namibia, Dubai, United States, Denmark, and Kuwait). Only lecturers and faculty members who been part and have experienced BL approach between 1 and 10 years met the selection criteria. The questionnaire was used to test the hypothesized model. Nearly all participants had taught courses in Science, Arts, Education, Engineering, Management, and other related courses. The mean length of teaching among participants was 8.5 years with a standard deviation of 0.7 years.

Data Analysis

Principal Component analysis and Structural equation modeling (SEM) approach were used as tools for data analysis using multivariate statistical approach of partial least squares. Sarstedt et al. (2014) confirmed that this technique is normally recommended when the aim is to confirm a theory from the constructs and the sample size is somewhat small.

TABLE 1 | Model construct summary.

Model constructs	Description
Institutional hygiene readiness	It represents the preparedness of the institution toward providing conducive environment to motivate faculty to want to use BL for teaching and learning. For instance, the availability of appropriate infrastructure, technology and policies that engender an ICT culture in the institution. This is confirmed in previous research (Machado, 2007; Whelan, 2008; Wong et al., 2014).
Faculty technology readiness	Level of technology efficacy or skills and how faculty members plan teaching to ensure that the pedagogic approach fits well to achieve the learning outcomes (Geng et al., 2019; Cutri and Mena, 2020; Sangwan et al., 2021).
Students' BL disposition	Relates to attributes within the BL environment that positively stimulate students' disposition to want to engage in learning in BL mode. For example, ease of use of the system and access to technical support.
Pedagogy technology fit	It is the alignment of teaching to attain a balance with online environments to achieve desired learning outcomes (Goodhue and Thompson, 1995; McGill and Klobas, 2009).
Positive motivation to adopt BL	The outcome derived from the influences of independent constructs that lead to a decision to adopt BL (Gautreau, 2011; Ibrahim and Nat, 2019).
Motivation confirmation	The stage where a decision to adopt BL for teaching is confirmed and faculty begin to use BL for teaching and learning.

All constructs of the measurement model in **Figure 1** as well as the mediation are based on the theoretical survey and can be categorized as reflective (Hair et al., 2012). For such measurement models, we use constructs validity (discriminate validity and convergent validity) and reliability analysis (Sarstedt et al., 2014). The reliability of internal consistency was analyzed by composite reliability and Cronbach's Alpha, and both exceeded the threshold of 0.7 (Sarstedt et al., 2014). To establish how well the collected data measures the construct of the study, psychometric properties, including Principal Component Analysis (PCA), reliability and confirmatory factor analysis (CFA) tests were carried out, as proposed by Anderson and Gerbin (1998). Principal component analysis with Varimax rotation was also carried out to remove statements that did not significantly contribute to the constructs as such all constructs with underlying statements entered the PCA.

DATA ANALYSIS

Introduction

The section presents and discusses the results in line with the hypothesized model. Six constructs with 26 items were used as independent variables to predict BL adoption mediated by motivation. Prior to that, descriptive statistics were used to measure the weight for each of the constructs based on the Likert scale. This was then followed by a path analysis (confirmatory factor analysis). The results from the path analysis were presented and passed through PCA to remove the items which could not load more than 0.5. Cronbach's Alpha was used to further confirm

TABLE 2 | University/Institution.

Institution	Frequency	Percent
University of Ghana	2	1.0
University of Cape Coast	9	4.3
Kwame Nkrumah University of Science and Technology	3	1.4
Methodist University College	9	4.3
University for Development Studies	9	4.3
International University of Management-Namibia	78	37.7
Aalborg University–Denmark	6	2.9
The University of North Carolina at Chapel Hill-United States	20	9.7
West Chester University of Pennsylvania	3	1.4
United Arab Emirates University-Dubai	3	3
Southern Illinois University-United States	3	3
Chicago State University	6	2.9
Ohio University-United States	3	1.4
University of Texas at Austin	3	1.4
University of North Texas at Dallas-United States	3	1.4
American University of Kuwait-Kuwait	3	1.4
GCC National	3	1.4
AAMUSTED-Ghana	3	1.4
Ghana Communication Technology University	38	18.4
Total	207	100

Source: Field Data (2021).

TABLE 3 | Years of teaching experience.

	Frequency	Percent	Valid percent	Cumulative percent
1–5	78	37.7	37.7	37.7
6–10	48	23.2	23.2	60.9
11–15	45	21.7	21.7	82.6
16–20	24	11.6	11.6	94.2
20+	12	5.8	5.8	100
Total	207	100	100	

Source: Field Data (2021).

the results and a re-specified model was developed and tested. Composite Reliability and Average Variance Extracted were used to further test the reliability and validity of the constructs, respectively. A path analysis was conducted for the re-specified model with model fitted test to demonstrate the rigorousness of the model. Finally, the results from the test were discussed and validated in the literature with the conclusions and implication of the study clearly elucidated.

Presentation of Results
Demographic Information
Table 2 illustrates the distribution of the institutions or universities of the respondents. Out of the total number of respondents, 37.7% represented respondents from the University of Namibia, 18.4% from the Ghana Communication Technology University and 9.7% represented The University of North Carolina at Chapel Hill. The Methodist University, University for Development Studies, and the University of Cape Coast had 4.3% responses. Aalborg University and University of Chicago both had 2.9 responses. All other universities had a total of 1.4%. The implication is that three times as many foreign universities participated in the survey as did local universities.

Table 3 below illustrates the teaching experience of the respondents from the surveyed universities. Out of the total number of respondents from the universities, 37.7% had 1–5 years of experience, 23.2% had taught between 6 and 10 years, 21.7% had 11–15 years teaching experience, 11.6% had taught from 16 to 20 years, whilst 5.8% had 20+ years teaching experience. The implication is that majority of the teachers had between 1 and 10 years teaching experience.

Table 4 shows a cross tabulation of the number of years' respondents had in teaching courses using blended learning approach. The category of 1–5 years had majority of lecturers (74%) with BL experience who had taught between 1 and 20 years cumulatively. The other 26% of lecturers had BL experience between 6 and 20 years with same teaching experience. This finding suggests most lecturers acquired the BL experience in this recent past 5 years, indicating the level of adoption of BL in these universities studied in this last 5 years.

Descriptive Analysis
The weighted mean and standard deviation for Institutional Hygiene Readiness for BL adoption accounted for 2.36 and 1.13, respectively (*with a 5-point Likert scale 1-Strongly Agree, 2-Agree, 3-Neutral, 4-Disagree, and 5-Strongly Disagree*). The mean shows that averagely all respondents agreed that Institutional Hygiene Readiness contributes to BL adoption. The standard deviation shows the level of dispersion of respondents' views with regards to Institutional Hygiene Readiness to the adoption of BL (see **Table 5**). The standard deviation of 1.13 shows a fair spread of the other views around the mean. The implication is that majority of the respondents agreed that Institutional Hygiene Readiness contributes significantly to BL adoption. Also, the weighted mean and standard deviation for Student Acceptance Disposition of BL adoption accounted for 2.16 and 0.92, respectively (see **Table 5**). The mean shows that averagely all respondents agreed that Student Acceptance Disposition of BL is a key construct which contributes to BL adoption. The standard deviation shows a good estimation of the mean indicating that very few people have diverse opinions of the contribution of the construct to BL adoption. Faculty Technology Readiness of BL adoption accounted for 2.27 and 0.99 on the weighted mean and standard deviation, respectively (see **Table 5**). The mean shows that averagely all respondents agreed that Faculty Technology Readiness contributes largely to BL adoption. The standard deviation shows a good estimation of the mean. The weighted mean and standard deviation for Pedagogy Technology Fit of BL adoption accounted for 2.18 and 0.99, respectively (see **Table 5**). The mean shows that averagely all respondents agreed that Pedagogy Technology Fit of BL contributes largely to BL adoption. The standard deviation shows a good estimation of the mean, depicting very few people had diverse opinions of the contributions of the Pedagogy Technology Fit to BL

TABLE 4 | Years of teaching experience × years of blended learning teaching cross tabulation.

		Years of blended learning teaching				Total
		1–5	6–10	11–15	16–20	
Years of teaching experience	1–5	78	0	0	0	78
	6–10	24	24	0	0	48
	11–15	27	12	6	0	45
	16–20	15	0	3	6	24
	20+	9	0	0	3	12
	Total	153	36	9	9	207

Source: Field Data (2021).

TABLE 5 | Descriptive statistics of model construct.

Model construct	Weighted Mean	Standard Deviation
Institutional hygiene readiness	2.36	1.13
Student acceptance disposition for BL adoption	2.16	0.92
Faculty technology readiness	2.27	0.99
Pedagogy technology fit	2.18	0.99
Motivation to adoption blended learning	2.53	1.01

Source: Field Data (2021).
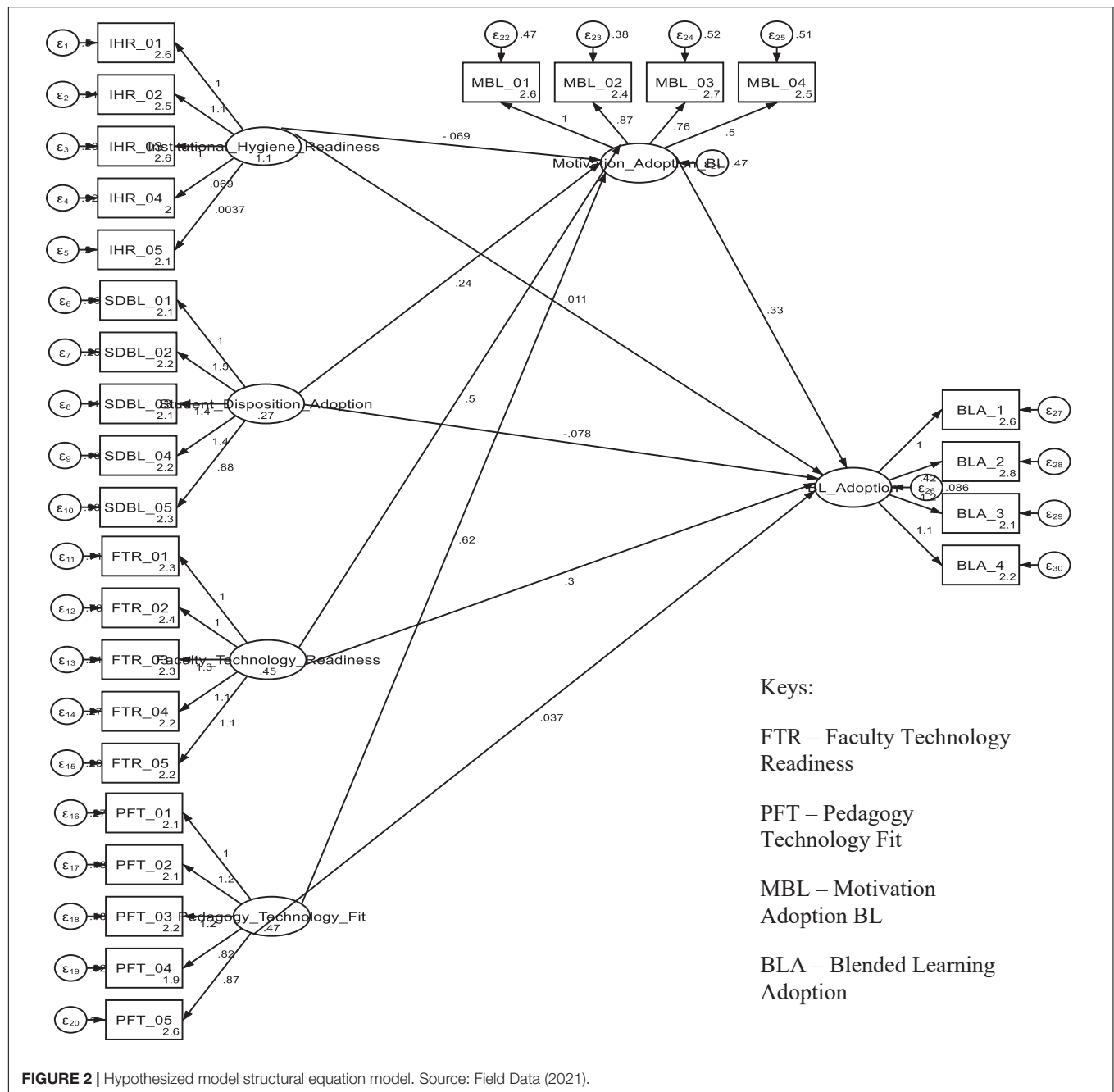
FIGURE 2 | Hypothesized model structural equation model. Source: Field Data (2021).

adoption. Motivation to Adoption Blended Learning of BL adoption accounted for 2.53 and 1.01, respectively, for mean and standard deviation (see **Table 5**). The mean shows that averagely all respondents agreed that Motivation to adopt BL significantly affects BL adoption.

Measurement of Constructs

The PCA was used to prune the variables in the hypothesized model to measurable constructs. This was to ensure that a rigorous process of measuring the model constructs was achieved. First a confirmatory factor analysis was conducted

based on the hypothesized model. Then constructs with factor loadings less than 0.5 were removed, and further confirmed using Cronbach's Alpha. Those constructs which passed the threshold of 0.7 were regrouped and a new model re-specified with the regrouped variables. The re-specified model was further tested using the path analysis and confirmed with the goodness of fit.

Hypothesized Model

Figure 2 shows the hypothesized model showing the constructs for the independent variables, mediating variables and the dependent variables. The results of the hypothesized model

TABLE 6 | Hypothesized model.

Hypothesis	Path coefficient (β)	Sig. (α < 0.05)	Remarks
Institutional hygiene readiness = > motivation	−0.07	0.22	Not supported
Student acceptance disposition = > motivation	0.24	0.11	Not supported
Faculty technology readiness = > motivation	0.50	0.01	Supported
Pedagogy technology fit = > motivation	0.62	0.01	Supported
Motivation = > BL adoption	0.33	0.01	Supported
Institutional hygiene readiness = > BL adoption	0.01	0.75	Not supported
Student acceptance disposition = > BL adoption	−0.08	0.39	Not supported
Faculty technology readiness = > BL adoption	0.30	0.01	Supported
Pedagogy technology fit = > BL adoption	0.37	0.68	Not supported

TABLE 7 | KMO, Bartlett's test, Cronbach's alpha and component matrix.

Variable	KMO	Bartlett's test	Cronbach's alpha	Component matrix	
Institutional hygiene readiness	0.679	0.001	0.729	IHR_01	0.905
				IHR_02	0.941
				IHR_03	0.929
				IHR_04	0.077
Student acceptance disposition for BL adoption	0.835	0.001	0.835	SDBL_01	0.700
				SDBL_02	0.879
				SDBL_03	0.900
				SDBL_04	0.881
				SDBL_05	0.558
Faculty technology readiness	0.788	0.001	0.860	FTR_01	0.750
				FTR_02	0.739
				FTR_03	0.875
				FTR_04	0.829
				FTR_05	0.831
Pedagogy technology fit	0.729	0.001	0.829	PFT_01	0.828
				PFT_02	0.871
				PFT_03	0.886
				PFT_04	0.673
				PFT_05	0.643
Motivation to adoption blended learning	0.781	0.001	0.825	BML_01	0.864
				BML_02	0.866
				BML_03	0.812
				BML_04	0.688
Blended learning adoption	0.658	0.001		BLA_1	0.578
				BLA_3	0.595
				BLA_4	0.604
Weighted average	**0.762**	**0.001**	**0.812**		

Source: Field Data (2021).

FIGURE 3 | Re-specified model. Source: Field Data (2021).
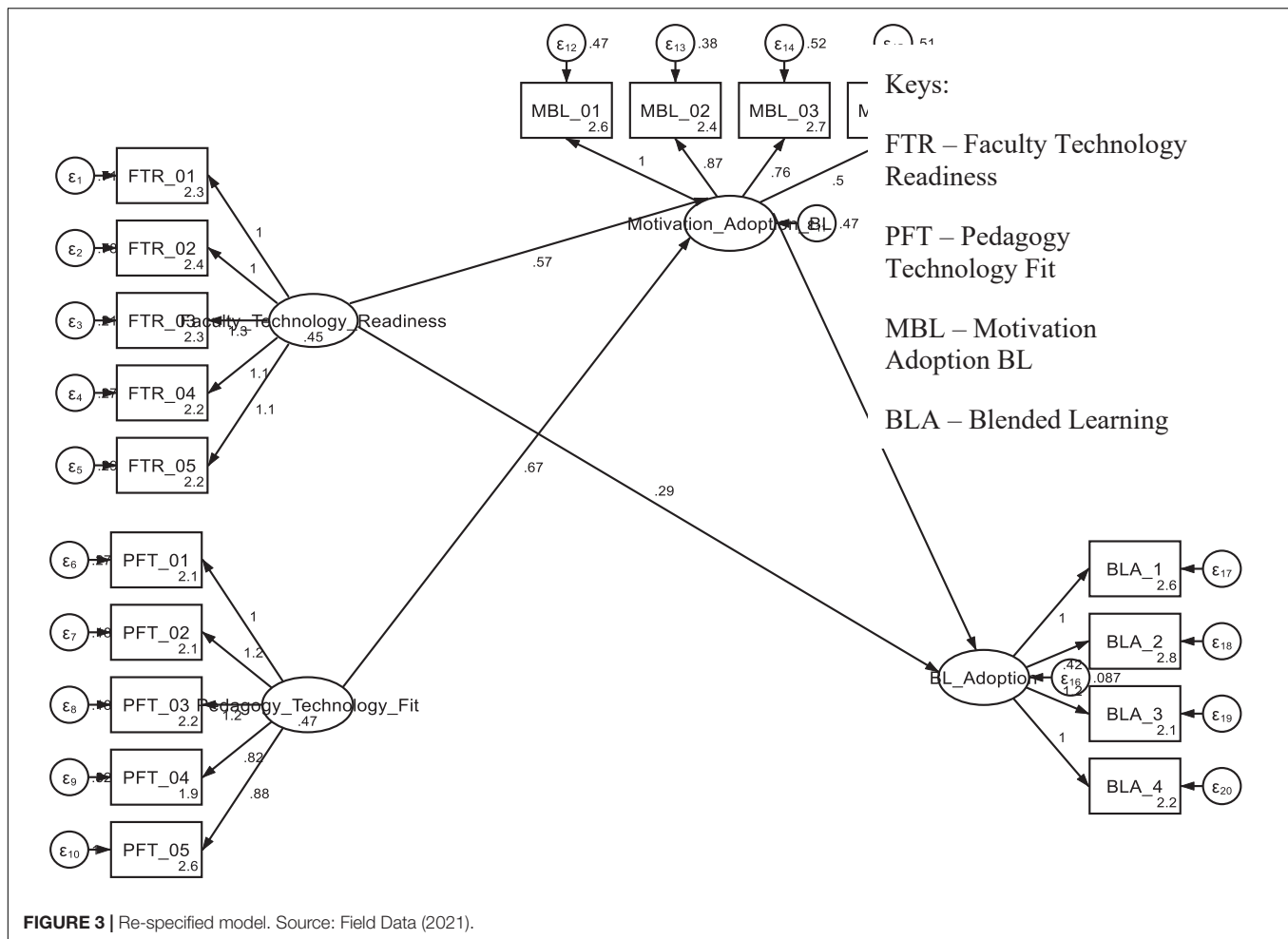
revealed that *Institutional Hygiene and Readiness, Student Acceptance Disposition, Pedagogy Technology Fit could not predict or explain BL adoption directly (see Table 6)* except *Faculty Technology Readiness* which predicted *BL adoption* (see **Table 6**). However, *Institutional Hygiene and Readiness and Student Acceptance Disposition* could not predict the mediating for (Motivation). But Faculty *Technology Readiness and Pedagogy Technology* could explain or predict the mediating factor (Motivation). As a result of these findings the study further conducted a PCA, Component Reliability and Average Variance Extracted test to ensure accuracy of the items measuring the constructs. A re-specified model was developed at the end of the test (see **Table 7** and **Figure 3**).

Principal Component Analysis: KMO, Bartlett's Test, Reliability and Validity

All constructs passed the Bartlett's test of sphericity with an average 0.01 ($\alpha < 0.05$) and Kaiser-Meyer-Olkin (KMO) average score of 0.762 was achieved which indicates suitability of the sample for factor analysis (see **Table 7**). As Hair et al. (2012) clarified, a factor loading scores higher than 0.5 for all items stated the satisfactory explanations of the item. Majority of the constructs (except two) had factor loadings greater 0.5.

Constructs with factor loadings less than 0.5 were removed from the item list. The analysis reconfirmed twenty-six factors with a cumulative weighted average total variance explained of 67% (see **Table 7**). The twenty-six items were rotated in the Rotated Component Matrix and results highlighted (see **Table 7**). From the **Table 7** below, results show a different grouping of items, measuring the construct and these new item groupings were further tested with Cronbach's Alpha. The Cronbach's Alpha showed an average Alpha value of 0.812 which is greater than the threshold of 0.7 as postulated by Hair et al. (2012), demonstrating the consistency in the responses elicited from the respondents.

A Composite Reliability score of 0.85 was generated; indicating the internal consistency of six (6) constructs with twenty-six rotated items using Microsoft Excel to compute the CR score. The Average Variance Extracted score of 0.62 was also accounted, which was higher than 0.5 recommended by Hair et al. (2012) indicating convergence validity. Likewise, the value of AVE below 0.5, showed the degree to which the operationalization of a construct dissimilar, confirming the existence of discriminate validity. From the results obtained, these requirements were not violated as indicated by Hair et al. (2012).

TABLE 8 | Re-specified model.

Hypothesis	Path coefficient (β)	Sig. (α < 0.05)	Remarks
Faculty technology readiness = > motivation	0.57	0.01	Supported
Pedagogy technology fit = > motivation	0.66	0.01	Supported
Motivation adoption BL = > BL adoption	0.33	0.01	Supported
Faculty technology readiness = > BL adoption	0.29	0.01	Supported

TABLE 9 | Goodness-of-fit.

Measurement	Fit indices hypothesized model	Fit indices re-specified model	Threshold	Remarks
Standardized Root Mean Squared	0.06	0.03	<0.8	Hu and Bentler (1999) and Kenny et al. (2015)
Comparative Fit Index (CFI)	0.68	0.85	>0.95	Byrne and van de Vijver (2010), Hair et al. (2012), Kline (2013), and Mahmoud and Khalifa (2015)
Tucker-Lewis Index (TLI)	0.65	0.86	>0.9	Byrne and van de Vijver (2010), Hair et al. (2012), Kenny et al. (2015), and Mahmoud and Khalifa (2015)

Source: Field Data (2021).

TABLE 10 | Direct, indirect and total effects of re-specified model.

Measurement	Direct effect	Indirect effect	Total effect
Faculty technology readiness = > motivation	0.57	0.19	0.22
Pedagogy technology fit = > motivation	0.67	0.22	0.22
Motivation adoption BL = > BL adoption	0.033	–	0.33
Significance level	0.01	0.01	0.01

Source: Field Data (2021).

Re-specified Model

The re-specified model (see **Figure 3**) revealed that Faculty Technology Readiness contributed 29% at a significant level of 0.05 on BL Adoption in the universities studied remained as the only construct that directly predicted BL Adoption without any mediation (see **Table 8**). Pedagogy Technology Fit could not predict BL Adoption but could predict BL adoption when mediated by Motivation for BL Adoption (see **Table 8**). Motivation for BL Adoption remained a direct predictor of BL Adoption as indicated earlier in the hypothesized model (see **Table 8**).

Generally, a **goodness-of-fit test** is a measure of how well observed data correspond to the fitted model. Kenny et al. (2015) noted that goodness-of-fit refers to how a hypothesized model reproduces the multivariate structure of a given set of the data. A goodness-of-fit index allows a researcher to claim that the model is a good one or that a mis-specified model is not necessarily a bad model.

The study examined the measurement model's goodness-of-fit based on research objectives and hypothesized model (Little et al., 2002). The model was re-specified to reduce complexity and likelihood of unwanted interaction and effects between the variables (Taylor and Mackinnon, 2008).

The study reported multiple fit indices as appropriate (Cabrera-Nguyen, 2010) to be able to make a claim of its model fit. The fit indices demonstrate the level of rigorousness of the

model after re-specification. Even though some constructs did not exceed the threshold mark, however, there was some level of improvement in the fit indices (see **Table 9**).

Baron and Kenny (1986) identified a direct effect (full mediation) and a case of both direct and indirect effects (partial mediation), which was confirmed by Zhao et al. (2010). In this study, both full and partial mediation were observed where Motivation to Adoption BL mediates between the independent constructs (Faculty Technology Readiness and Pedagogy Technology Fit) and BL Adoption. While a full mediation (direct effect) was observed between Faculty Technology Readiness and BL Adoption, a partial-mediated effect was observed between Pedagogy Technology Fit and BL Adoption. The study observes a total effect of 22% each for both Faculty Technology Readiness and Pedagogy Technology Fit on BL Adoption (see **Table 10**). The implication is that the factors (Faculty Technology Readiness and Pedagogy Technology Fit) that contribute to BL Adoption in the universities studied positively contribute 22% in total.

DISCUSSION OF RESULTS

The aim of this study was to test and validate the FBLAM and to explain the constructs that influence faculty to adopt BL. Overall, the findings in this study show empirical support for the

hypothesis that the four independent constructs can predict the effects on faculty motivation to adopt BL. As a result of these findings, the proposed model appears to be a good match in that it provides an acceptable description of the interactions among the elements that impacted faculty intentions to utilize BL for teaching and learning.

From the results of the hypothesized model, institutional hygiene readiness and student acceptance disposition to accept BL could not predict or contribute directly to faculty motivation. Whereas studies (Porter et al., 2014; Mestan, 2019) suggest that institutional readiness and students disposition to BL are relevant factors to successful adoption of BL what could account for these constructs not finding predictive support from the model could be the case that respondents are from institutions with mature implementation/growth stages of BL implementations (Graham et al., 2013). The result is that most respondents are confident in their abilities and understand the importance of BL learning in the process of facilitating the learning experience for their pupils. The institutional structures and processes for faculty members are being supported in this respect to establish the most effective and suitable approaches to integrate BL throughout the Universities.

However, in the re-specified model, faculty technology readiness and pedagogy-technology-fit had direct influence on faculty motivation to adopt BL. These are consistent with current research (Goodhue and Thompson, 1995; McGill and Klobas, 2009; Archibald et al., 2021). From the direct influences of faculty technology readiness and its positive effect on motivation to adopt BL, it is useful to infer that when faculty members have the implicit technology competences to design and use instructional technology, they have positive feelings to teach in BL mode. These feelings according to Teo (2011) reinforce faculty motivation to use technology. Pedagogic Technology Fit had a direct influence on motivation of faculty to adopt BL (i.e., β = 0.66, α-value = 0.01). This affirms the fact that the pedagogy used must have positive significance within the domain in which the instruction activities are conducted using technology as a medium to promote the teaching and learning (Lee et al., 2017). Consequently, there is a practical implication for HEIs to provide continuous training and development to equip faculty in their teaching experiences.

Poor pedagogy technology fit discourages some instructors from using the LMS (Martin et al., 2019a). When teachers perceive that the instructional method can adequately fit the medium (technology) being employed this can strengthen their intention to adopt the technology in this case (LMS) as the domain to teach in BL mode (Martin et al., 2019b). Similarly, motivation had a direct influence of faculty BL adoption. This is consistent with studies by Gautreau (2011) and Ibrahim and Nat (2019). As a result of the validation of the motivation as an essential mediating element for BL implementation, both the extrinsic and intrinsic motivational variables have a significant beneficial impact on instructors' motivation to adopt BL in higher education institutions. Furthermore, it is critical for every higher education institution to assess their instructors' motivation about

any kind of technology before considering its ultimate adoption. This model can serve as a foundation in this regard, and higher education institutions are free to investigate and include any other factors that they believe would increase their instructors' motivation in the BL setting (Ibrahim and Nat, 2019). Again, there is a policy implication for this finding. The finding affirms that higher education institutions readiness and support have provided diverse motivation to utilize technology to teach. Hence, institutions must enforce the policy to enhance the effective usage of the technology that can promote quality teaching and learning within the blended learning environment.

CONCLUSION

Results of our study indicate the effects of institutional hygiene preparedness, faculty technology readiness, student disposition to BL and pedagogic technology fit, which are mediated by motivation, on the faculty's willingness to embrace BL. This work contributes to the body of knowledge about blended learning and the elements that influence it, which has not been adequately examined previously. By examining the effects of these separate variables on faculty adoption, our research provides empirical data and insights for educators to better understand faculty adoption of BL to improve teaching and learning, ultimately leading to higher learning outcomes. The findings of this investigation indicate that the suggested model provides a satisfactory match to the data set under consideration. Future study might examine if the model is invariant across different personal (e.g., gender, computer experience), organizational, and technical variables, among other things. It may be possible to discover the culture-invariant characteristics that impact teachers' intentions to employ technology through comparative research across nations or cultures.

Recommendation

The literature gaps identified in this study suggests the lack of operationalized model for faculty BL adoption in the Ghanaian Higher Institution of Learning. It is recommended that the hypothesized and tested model extended to include other variables to explain other relevant issues mitigating the adoption and implementation of BL in higher institutions in Ghana. The findings present deep insights to guide policy implementation on BL adoption among the universities in Ghana and beyond. Further research work can investigate the factors that accounted for non-predictability of Institutional Hygiene Readiness among others to guide managers and administrators of higher institution of learning to make informed decisions.

Limitations of the Study

It became clear to us over the course of doing this research that the area of blended learning research is still in its early stages (Graham et al., 2019). There should be a greater emphasis on the creation of models and theories that may be used to guide practice in the future (Graham et al., 2014). Finding blended learning models that were supported by current measurement

methodologies proved to be difficult, which was disappointing. In this case, it is possible that only instructors who were comfortable with technology responded to the online questionnaire, which might have resulted in a lack of inclusiveness among the teachers at each school, impairing the study's ability to generalize its findings. Future studies should consider including pen and paper data collection into data collection strategy in addition to online data collection to make it more inclusive. Those who prefer to answer on paper or who have limited computer access will be able to take use of this alternative.

REFERENCES

Aboagye, E., Yawson, J. A., and Appiah, K. N. (2020). COVID-19 and E-Learning: the challenges of students in tertiary institutions. *Soc. Educ. Res.* 2, 109–115. doi: 10.37256/ser.122020422

Adarkwah, M. A. (2021). "I'm not against online teaching, but what about us?": ICT in Ghana post Covid-19. *Educ. Inf. Technol.* 26, 1665–1685. doi: 10.1007/s10639-020-10331-z

Adekola, J., Dale, V. H. M., and Gardiner, K. (2017). Development of an institutional framework to guide transitions into enhanced blended learning in higher education. *Res. Learn. Technol.* 25, 1–16. doi: 10.25304/rlt.v25.1973

Adiyarta, K., Napitupulu, D., Rahim, R., Abdullah, D., and Setiawan, M. I. (2018). Analysis of e-learning implementation readiness based on integrated elr model. *J. Phys. Conf. Ser.* 1007:012041. doi: 10.1088/1742-6596/1007/1/012041

Al-Ayed, S. I., and Al-Tit, A. A. (2021). Factors affecting the adoption of blended learning strategy. *Int. J. Data Netw. Sci.* 5, 267–274. doi: 10.5267/j.ijdns.2021.6.007

Albrahim, F. A. (2020). Online teaching skills and competencies. *Turkish Online J. Educ. Technol.* 19, 9–20.

Anderson, J. C., and Gerbin, D. (1998). Structural equation modeling in practice: a review and recommended two-step approach. *Psychol. Bull.* 103, 411–423. doi: 10.1504/EJIM.2021.114662

Anthony Jnr, B. (2021). Institutional factors for faculty members' implementation of blended learning in higher education. *Educ. Train.* 63, 701–719. doi: 10.1108/ET-06-2020-0179

Anthony, B., Kamaludin, A., Romli, A., Raffei, A. F. M., Eh Phon, D. N., Abdullah, A., et al. (2019). Exploring the role of blended learning for teaching and learning effectiveness in institutions of higher learning: an empirical investigation. *Educ. Inf. Technol.* 24, 3433–3466. doi: 10.1007/s10639-019-09941-z

Antwi-Boampong, A. (2020). Towards a faculty blended learning adoption model for higher education. *Educ. Inf. Technol.* 25, 1639–1662. doi: 10.1007/s10639-019-10019-z

Archambault, L., and Larson, J. (2015). Pioneering the digital age of instruction: learning from and about K-12 online teachers. *J. Online Learn. Res.* 1, 49–83.

Archibald, D. E., Graham, C. R., and Larsen, R. (2021). Validating a blended teaching readiness instrument for primary/secondary preservice teachers. *Br. J. Educ. Technol.* 52, 536–551. doi: 10.1111/bjet.13060

Baron, R. M., and Kenny, D. A. (1986). The moderator-mediator variable distinction in social psychological research. conceptual, strategic, and statistical considerations. *J. Pers. Soc. Psychol.* 51, 1173–1182. doi: 10.1037/0022-3514.51.6.1173

Blieck, Y., Zhu, C., Schildkamp, K., Struyven, K., Pynoo, B., and Cindy, L. (2020). A conceptual model for effective quality management of online and blended learning. *Electr. J. Elearn.* 18, 189–204. doi: 10.34190/EJEL.20.18.2.007

Byrne, B. M., and van de Vijver, F. J. R. (2010). Testing for measurement and structural equivalence in large-scale cross-cultural studies: addressing the issue of nonequivalence. *Int. J. Test.* 10, 107–132. doi: 10.1080/15305051003637306

Cabrera-Nguyen, P. (2010). Author guidelines for reporting scale development and validation results in the journal of the society for social work and research. *J. Soc. Soc. Work Res.* 1, 99–103. doi: 10.5243/jsswr.2010.8

Callo, E. C., and Yazon, A. D. (2020). Exploring the factors influencing the readiness of faculty and students on online teaching and learning as an alternative delivery mode for the new normal. *Univ. J. Educ. Res.* 8, 3509–3518. doi: 10.13189/ujer.2020.080826

DATA AVAILABILITY STATEMENT

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author.

AUTHOR CONTRIBUTIONS

The author confirms being the sole contributor of this work and has approved it for publication.

Chen, K. C., and Jang, S. J. (2010). Motivation in online learning: testing a model of self-determination theory. *Comput. Hum. Behav.* 26, 741–752. doi: 10.1016/j.chb.2010.01.011

Cheon, J., Lee, S., Crooks, S. M., and Song, J. (2012). An investigation of mobile learning readiness in higher education based on the theory of planned behavior. *Comput. Educ.* 59, 1054–1064. doi: 10.1016/j.compedu.2012.04.015

Cutri, R. M., and Mena, J. (2020). A critical reconceptualization of faculty readiness for online teaching. *Distance Educ.* 41, 361–380. doi: 10.1080/01587919.2020.1763167

Dennehy, D., Kasraian, L., Raghallaigh, P. O., and Conboy, K. (2016). "Product market fit frameworks for lean product development," in *Proceedings of the R&D Management Conference, July*, (Cambridge), 1–11.

Fathema, N., Shannon, D., and Ross, M. (2015). Expanding The Technology Acceptance Model (TAM) to examine faculty use of Learning Management Systems (LMSs) in higher education institutions. *MERLOT J. Online Learn. Teach.* 11, 210–232.

Garrote, R., and Pettersson, T. (2016). Lecturers' attitudes about the use of learning management systems in engineering education: a Swedish case study. *Australasian J. Educ. Technol.* 23, 1–19. doi: 10.14742/ajet.1256

Gautreau, C. (2011). Motivational factors affecting the integration of a learning management system by faculty. *J. Educ. Online* 8, 1–25.

Geng, S., Law, K. M. Y., and Niu, B. (2019). Investigating self-directed learning and technology readiness in blending learning environment. *Int. J. Educ. Technol. High. Educ.* 16:17. doi: 10.1186/s41239-019-0147-0

Goodhue, D. L., and Thompson, R. L. (1995). Task-technology fit and individual performance. *MIS Q. Manag. Inf. Syst.* 19, 213–233. doi: 10.2307/249689

Graham, C. R., Borup, J., Pulham, E., and Larsen, R. (2019). K–12 Blended teaching readiness: model and instrument development. *J. Res. Technol. Educ.* 51, 239–258. doi: 10.1080/15391523.2019.1586601

Graham, C. R., Henrie, C. R., and Gibbons, A. S. (2014). "Developing models and theory for blended learning research", in *Blended Learning: Research Perspectives*, Vol. 2, eds A. G. Picciano, C. D. Dziuban, and C. R. Graham (New York, NY: Routledge), 13–33.

Graham, C. R., Woodfield, W., and Harrison, J. B. (2013). A framework for institutional adoption and implementation of blended learning in higher education. *Internet High. Educ.* 18, 4–14. doi: 10.1016/j.iheduc.2012.09.003

Hair, J. F., Sarstedt, M., Ringle, C. M., and Mena, J. A. (2012). An assessment of the use of partial least squares structural equation modeling in marketing research. *J. Acad. Mark. Sci.* 40, 414–433. doi: 10.1007/s11747-011-0261-6

Hartnett, M. (2016). *Motivation in Online Education*. Berlin: Springer. doi: 10.1007/978-981-10-0700-2

Hoffman, M. S. (2013). *An examination of motivating factors on faculty participation in online higher education (Doctoral dissertation). NDissertaition, Northeastern University, February*. Boston, MA: Northeastern University, 146.

Hong, J. C., Hwang, M. Y., Liu, M. C., Ho, H. Y., and Chen, Y. L. (2014). Using a "prediction-observation-explanation" inquiry model to enhance student interest and intention to continue science learning predicted by their Internet cognitive failure. *Comput. Educ.* 72, 110–120. doi: 10.1016/j.compedu.2013.10.004

Hu, L. T., and Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: conventional criteria versus new alternatives. *Struct. Equ. Model.* 6, 1–55. doi: 10.1080/10705519909540118

Ibrahim, M. M., and Nat, M. (2019). Blended learning motivation model for instructors in higher education institutions. *Int. J. Educ. Technol. High. Educ.* 16:12. doi: 10.1186/s41239-019-0145-2

Junus, K., Santoso, H. B., Putra, P. O. H., Gandhi, A., and Siswantining, T. (2021). Lecturer readiness for online classes during the pandemic: a survey research. *Educ. Sci.* 11:139. doi: 10.3390/educsci11030139

Kenny, D. A., Kaniskan, B., and McCoach, D. B. (2015). The performance of RMSEA in models with small degrees of freedom. *Sociol. Methods Res.* 44, 486–507. doi: 10.1177/0049124114543236

Kline, R. B. (2013). Assessing statistical aspects of test fairness with structural equation modelling. *Educ. Res. Eval.* 19, 204–222. doi: 10.1080/13803611.2013. 767624

Lee, J., Lim, C., and Kim, H. (2017). Development of an instructional design model for flipped learning in higher education. *Educ. Technol. Res. Dev.* 65, 427–453. doi: 10.1007/s11423-016-9502-1

Legaspi, M., Acsaran, A., Bahoy, D., Cabildo, P., and Molina, R. (2021). Readiness, challenges and coping strategies of selected faculty in an academic institution towards teaching in new normal. *J. Xidian Univ.* 15, 467–475. doi: 10.37896/jxu15.5/052

Lin, W. S., and Wang, C. H. (2012). Antecedences to continued intentions of adopting e-learning system in blended learning instruction: a contingency framework based on models of information system success and task-technology fit. *Comput. Educ.* 58, 88–99. doi: 10.1016/j.compedu.2011.07.008

Little, T. D., Cunningham, W. A., Shahar, G., and Widaman, K. F. (2002). To parcel or not to parcel: exploring the question, weighing the merits. *Struct. Equ. Model.* 9, 151–173. doi: 10.1207/S15328007SEM0902_1

MacDonald, C., and Reid, G. (2013). Instructional strategies of inclusive physical education teachers: development and validation of a self-determination scale. *Eur. J. Adapted Phys. Activity* 6, 43–56. doi: 10.5507/euj.2013.004

Machado, C. (2007). Developing an e-readiness model for higher education institutions: results of a focus group study. *Br. J. Educ. Technol.* 38, 72–82. doi: 10.1111/j.1467-8535.2006.00595.x

Mahmoud, A. B., and Khalifa, B. (2015). A confirmatory factor analysis for SERVPERF instrument based on a sample of students from Syrian universities. *Educ. Train.* 57, 343–359. doi: 10.1108/ET-04-2014-0038

Maldonado, U. P. T., Khan, G. F., Moon, J., and Rho, J. J. (2011). E-learning motivation and educational portal acceptance in developing countries. *Online Inf. Rev.* 35, 66–85. doi: 10.1108/14684521111113597

Martin, F., Budhrani, K., and Wang, C. (2019b). Examining faculty perception of their readiness to teach online. *Online Learn. J.* 23, 97–119. doi: 10.24059/olj.v23i3.1555

Martin, F., Budhrani, K., Kumar, S., and Ritzhaupt, A. (2019a). Award-winning faculty online teaching practices: roles and competencies. *Online Learn. J.* 23, 184–205. doi: 10.24059/olj.v23i1.1329

Martin, F., Wang, C., Jokiaho, A., May, B., and Grübmeyer, S. (2019c). Examining faculty readiness to teach online: a comparison of US and German educators. *Eur. J. Open Distance Elearn.* 22, 53–69. doi: 10.2478/eurodl-2019-0004

Martin, J. (2010). *Applying the Motivation-Hygiene Theory As a Means of Measuring Learner Satisfaction With Blended Learning Courses in Higher Education a Aplicação Da Teoria Da Motivação-Higiene Como Meio De Medida Da Satisfação Dos Alunos Em Cursos De B-Learning No Ensino.* Aveiro: Universidade de Aveiro.

Masterman, E., and Craft, B. (2013). Designing and evaluating representations to model pedagogy. *Res. Learn. Technol.* 21:20205. doi: 10.3402/rlt.v21i0.20205

McGill, T. J., and Klobas, J. E. (2009). A task-technology fit view of learning management system impact. *Comput. Educ.* 52, 496–508. doi: 10.1016/j.compedu.2008.10.002

Mercado, C. A. (2008). *Readiness Assessment Tool for an E-Learning Environment Implementation: Special Issue of the International Journal of the Computer, the Internet and Management, 1–11.* Available online at: https://www.academia.edu/3705074/Readiness_Assessment_Tool_for_an_eLearning_Environment_Implementation

Mestan, K. (2019). Create a fine blend: an examination of institutional transition to blended learning. *Australasian J. Educ. Technol.* 35, 70–84. doi: 10.14742/ajet.3216

Nikou, S. A., and Economides, A. A. (2017). Mobile-based assessment: integrating acceptance and motivational factors into a combined model of self-determination theory and technology acceptance. *Comput. Hum. Behav.* 68, 83–95. doi: 10.1016/j.chb.2016.11.020

Okojie, M. C., Olinzock, A. A., and Okojie-Boulder, T. C. (2006). The pedagogy of technology integration. *J. Technol. Stud.* 32, 66–71. doi: 10.21061/jots.v32i2.a.1

Parasuraman, A. (2000). Technology Readiness Index (Tri): a multiple-item scale to measure readiness to embrace new technologies. *J. Serv. Res.* 2, 307–320. doi: 10.1177/109467050024001

Pereira, I., and Figueiredo, A. D. (2010). "Promoting motivation and participation in higher education: a b-learning experience," in *Proceedings - Frontiers in Education Conference, FIE,* (Arlington, VA) 1–6. doi: 10.1109/FIE.2010.5673204.

Porter, W. W., Graham, C. R., Spring, K. A., and Welch, K. R. (2014). Blended learning in higher education: institutional adoption and implementation. *Comput. Educ.* 75, 185–195. doi: 10.1016/j.compedu.2014.02.011

Rahmawati, N. I., Fauziati, E., and Marmanto, S. (2021). Investigating the institutional blended learning adoption framework in higher education. *Indonesian J. EFL Linguist.* 6:101. doi: 10.21462/ijefl.v6i1.345

Reeve, J. (2015). "Extrinsic rewards and inner motivation," in *Handbook of Classroom Management,* eds C. M. Evertson and C. S. Weinstein (Mahwah, NJ: Lawrence Erlbaum Associates Publishers), 645–664. doi: 10.4324/9780203874783.ch24

Sangwan, A., Sangwan, A., and Punia, P. (2021). Development and validation of an attitude scale towards online teaching and learning for higher education teachers. *TechTrends* 65, 187–195. doi: 10.1007/s11528-020-00561-w

Sarstedt, M., Ringle, C. M., and Hair, J. F. (2014). PLS-SEM: looking back and moving forward. *Long Range Plan.* 47, 132–137. doi: 10.1016/j.lrp.2014.02.008

Sørebø, Ø, Halvari, H., Gulli, V. F., and Kristiansen, R. (2009). The role of self-determination theory in explaining teachers' motivation to continue to use e-learning technology. *Comput. Educ.* 53, 1177–1187. doi: 10.1016/j.compedu.2009.06.001

Susanto, R., Rachmadtullah, R., and Rachbini, W. (2020). Technological and pedagogical models: analysis of factors and measurement of learning outcomes in education. *J. Ethnic Cult. Stud.* 7, 1–14. doi: 10.29333/ejecs/311

Tang, C. M. (2013). Readiness for blended learning: understanding attitude of university students. *Int. J. Cyber Soc. Educ.* 6, 79–100. doi: 10.7903/ijcse.1086

Taylor, A. B., and Mackinnon, D. P. (2008). Mediated effect. *Organ. Res. Methods* 1979, 241–269.

Teo, T. (2011). Factors influencing teachers' intention to use technology: model development and test. *Comput. Educ.* 57, 2432–2440. doi: 10.1016/j.compedu.2011.06.008

Teo, T., Doleck, T., Bazelais, P., and Lemay, D. J. (2019). Exploring the drivers of technology acceptance: a study of Nepali school students. *Educ. Technol. Res. Dev.* 67, 495–517. doi: 10.1007/s11423-019-09654-7

Tubaishat, A., and Lansari, A. (2011). Are students ready to adopt E-Learning? A preliminary E-readiness study of a University in the Gulf Region. *Int. J. Inf. Commun. Technol. Res.* 1, 210–215.

Whelan, R. (2008). Use of ICT in education in the South Pacific: findings of the Pacific eLearning observatory. *Distance Educ.* 29, 53–70. doi: 10.1080/01587910802004845

Wong, L., Tatnall, A., and Burgess, S. (2014). A framework for investigating blended learning effectiveness. *Educ. Train.* 56, 233–251. doi: 10.1108/ET-04-2013-0049

Zhao, X., Lynch, J. G., and Chen, Q. (2010). Reconsidering Baron and Kenny: myths and truths about mediation analysis. *J. Consum. Res.* 37, 197–206. doi: 10.1086/651257

Relationships Between Undergraduate Student Performance, Engagement, and Attendance in an Online Environment

Thomas J. Jones*

Department of Earth, Ocean and Ecological Sciences, University of Liverpool, Liverpool, United Kingdom

Monitoring student attendance and engagement is common practice during undergraduate courses at university. Attendance data typically show a strong positive relationship with student performance and regular monitoring is an important tool to identify students who may require additional academic provisions, wellbeing support and pastoral care, for example. However, most of the previous studies and our framework for monitoring attendance and engagement is based on traditional on-campus, in-person delivery. Accelerated by the COVID-19 pandemic, our transition to online teaching delivery requires us to re-evaluate what constitutes attendance and engagement in a purely online setting and what are the most accurate ways of monitoring. Here, I show how statistics derived from student interaction with a virtual learning environment, Canvas, can be used as a monitoring tool. I show how basic statistics such as the number and frequency of page views are not adequate and do not correlate with student performance. A more in-depth analysis of video viewing duration, rather than simple page clicks/views is required, and weakly correlates with student performance. Lastly, I provide a discussion of the potential pitfalls and advantages of collecting such data and provide a perspective on some of the associated challenges.

Keywords: academic performance, online education, virtual learning environment, student attendance, online engagement, online higher education, course design

INTRODUCTION

Both student attendance and engagement during university level courses are commonly related to student performance (e.g., Jones, 1984; Clump et al., 2003; Gump, 2005). There have been numerous studies that relate synchronous attendance at on-campus or in-person lecture sessions to academic performance. Where performance is usually measured by final examination grade, since the success in examination commonly relates to the learner meeting the intended learning objectives. Numerous, largely discipline specific empirical studies have convincingly shown that student attendance is strongly correlated with performance (e.g., Jones, 1984; Launius, 1997; Rodgers, 2001; Sharma et al., 2005; Marburger, 2006). However, other studies have addressed how such attendance-performance relationships are not equal for all students and is dependent on numerous student characteristics. For example, more pronounced negative effects of poor attendance

are observed for low-performing students (Westerman et al., 2011). Furthermore, student ambition (e.g., desire to meet job entry grade), personal study skills, work habit, self-motivation, and personal discipline all contribute to the relationship between attendance and performance (Lievens et al., 2002; Robbins et al., 2004; Credé and Kuncel, 2008; Credé et al., 2010). These interconnected factors can make attendance-performance relationships challenging to untangle.

There is also an extensive body of work showing that active learning techniques and the associated student engagement during teaching leads to a greater number of students meeting the learning outcomes and thus, by extension, improved academic performance. The methods for performing active learning and increasing student engagement are diverse and can include group pair-share exercises, benchtop demonstrations, cooperative problem solving exercises, peer-led inquiry, and research project experiences, for example (Farrell et al., 1999; Andersen, 2002; Seymour et al., 2004; Knight and Wood, 2005; Baldock and Chanson, 2006; Jones and Ehlers, 2021). However, irrespective of method, in general all these active learning strategies lead to increased student engagement and generally succeed in supporting students to meet learning outcomes (Froyd, 2007; Freeman et al., 2014). A large proportion of this previous work on student attendance, engagement and the relationship to performance has focused on synchronous in-person delivery. The extent to which these findings can be related to asynchronous online delivery and exactly what constitutes "engagement" and "attendance" in a purely online environment remains unclear and an active area of research.

There has been a growing move to online or hybrid learning. Despite the additional time investment required by the instructor to create effective online or hybrid teaching materials (McFarlin, 2008; Wieling and Hofman, 2010), there are multiple benefits and increased online learning may be an important method to widen participation across numerous and diverse student groups. Students can select the time and place to conduct their own learning, especially when all the material is delivered asynchronously. This supports students who have other commitments (e.g., caring responsibilities), live in remote geographical locations, or have health concerns, for example (Colorado and Eberle, 2012; Kahu et al., 2013; Johnson, 2015; Chung et al., 2022). It can also make the learning environment more inclusive, for example performing practical or fieldwork-based activities online enables participation by a wider number of students, especially those with disabilities (Giles et al., 2020). The move to online teaching was greatly accelerated due to the COVID-19 pandemic, forcing the global education sector, across all levels, to rapidly switch to exclusively online teaching (Mishra et al., 2020; Chung et al., 2022). Furthermore, going forward, universities worldwide are encouraged and sometimes required to offer a hybrid or blended learning approach for students (Chung et al., 2022).

Thus, given the importance and interrelationship between attendance, engagement, academic performance, and student wellbeing we must understand how to effectively monitor such factors in an online educational setting. Most of our attendance monitoring strategies have only been tested for in-person,

traditional on-campus delivery. They remain untested for online teaching and such strategies might be unpractical. Specifically, here, I will address the following research questions:

- What methods can be used to effectively monitor attendance and engagement in a purely online environment?
- Does increased online attendance and engagement contribute to increased academic performance?
- What are the challenges faced when monitoring student attendance during asynchronous and synchronous online learning?

In this study, following these research questions, I show how student viewing statistics from the virtual learning environment (VLE) platform, Canvas, can and cannot be used to monitor "attendance" and "engagement." Lastly, I also provide a perspective on the opportunities, challenges faced and potential pitfalls of using such data for student monitoring at universities.

METHODS

Student Population and Setting

The data presented here were generated during an undergraduate course entitled "Volcanology and Geohazards" at the University of Liverpool, United Kingdom. The course was taken by 31 students of mixed gender during the second year of their undergraduate study. The course is a compulsory module for the undergraduate degree programs, BSc/MESci Geology and BSc/MESci Geology and Physical Geography, with 24 and 7 students enrolled on these programs respectively. The only difference between the BSc and MESci degree is the degree length, the BSc programs are 3 years whereas the MESci programs have an additional year of advanced study to form a 4-year program. The course analyzed here was taken by all students in their second year of study, thus is not impacted by variations in degree type (i.e., BSc vs. MESci). No age or ethnicity data is available for this study. This study was approved by the University of Liverpool's ethics committee, details are provided in the Ethics Statement.

Course Information and the Virtual Learning Environment

The course analyzed in this study started on the 8th of February 2021 in the second (winter) semester of the 2020–2021 academic year and was delivered solely online. The course "Volcanology and Geohazards" ran for a total of 12 weeks. It was split equally between these topics, with the volcanology teaching occurring in the first 6 weeks and the geohazards component in weeks 7–12. The volcanology component is the sole focus here and comprised 10 pre-recorded asynchronous lectures, 2 online synchronous 1-h guest lectures and 5 online synchronous 2-h practical sessions (**Table 1**). The online practical sessions used handwritten calculation exercises and Excel based tasks to supplement material delivered in the online lectures. The students were assessed by an online timed quiz given in teaching week 6 and a final open book online essay exam question given

TABLE 1 | Volcanology syllabus listed for each teaching week.

Week	Asynchronous lecture		Synchronous practical sessions	Guest synchronous lecture
1	Classifying eruptions (33 min)	Scaling and experiments (47 min)	Classifying eruptions	–
2	Magma properties (64 min)	Magma rheology (52 min)	Analog experiments	–
3	Basaltic lavas (54 min)	LIPs, climate, fissures (73 min)	Rheology	Granular flows
4	Felsic lavas (36 min)	Fragmentation (60 min)	Conduit flow	–
5	Eruption columns (39 min)	PDCs (47 min)	Isopach maps	Mars volcanism

Durations of the pre-recorded asynchronous lecture videos are shown in the parentheses.

FIGURE 1 | Screenshots of the VLE layout. The volcanology component home page is shown on the left. From this home page all the asynchronous teaching material can be accessed. The numbered lectures link to a page with the pre-recorded lecture video embedded. The hyperlinked week numbers (e.g., "Week 1") listed at the bottom of the home page link to a file collection containing the pdf lecture slides, question sheets for the practical sessions and answers. Representative links are shown by the arrows.

in the summer examination period, due 16 weeks after the volcanology teaching began.

The synchronous delivery was performed using the video-conferencing platform, Zoom. All the asynchronous lectures and materials (e.g., lecture slides, question sheets, spreadsheets, solutions) associated with the synchronous sessions were made available to the students using the virtual learning environment (VLE), Canvas. The VLE can be accessed using a web browser on any device and is used for all courses at the University of Liverpool. Canvas is widely used in higher education settings both within the United Kingdom and globally, however, there is lots of flexibility and thus variability of how course content is structured on the VLE. **Figure 1** shows the Canvas layout for the volcanology component of the course investigated here. From the volcanology component homepage (**Figure 1**) all the asynchronous teaching material can be accessed. The hyperlinks on the numbered and named lectures link to a separate page with the pre-recorded lecture video embedded. The hyperlinked numbered weeks at the bottom of the page (**Figure 1**) link to a file repository where the pdf copies of the lecture slides,

the practical session questions sheets, resources, and practical solutions are located.

Data Collection and Analysis Methods

In this study three types of data were collected: (a) synchronous attendance; (b) student grades and (c) access to materials on the VLE. For all data, immediately after collection, all student names were removed and each student was assigned a random number between 1 and 31 such that these data remained truly anonymous and could not be deduced by the alphabetical order of surnames, for example.

Attendance was recorded for all synchronous sessions (i.e., guest lectures and practical sessions). This was done by matching Zoom profile names to the class register. Student grades are used as a measure of performance and were taken from the online quiz, the essay exam, and the average of these two assignments, assuming an equal weighting to give a final volcanology grade. For comparative purposes, the average student grade obtained in the first 2 years of university study was also recorded. These data were taken directly from the university's internal records system.

The access to the VLE, Canvas, was assessed using the built-in "new analytics" tool. For each student this tool lists the number of page/resource views in each week. The following data were manually extracted: the number of students that accessed each resource at least once; the total number of resource views for each student and, the week that each student accessed a resource. A second built-in tool entitled "Canvas studio" was used to extract viewing statistics related to the embedded asynchronous videos. For each student, and for each video, this tool shows the specific video segments that have been watched. These viewing data are reported for every 30-second video segment for videos less than 1 h in duration, and for every 1-min video segment for videos greater than 1 h in duration. Using this tool, for each asynchronous lecture video, the duration viewed by each student at least once was manually recorded. Unfortunately, it is not possible with the current VLE platform to identify how many times a student watched each asynchronous lecture video. Also, it cannot be determined whether the student viewed the lecture all at once or in a series of sittings. Once all these data had been collected, grouped into a spreadsheet, and anonymized it was imported into Matlab, where all data plotting and fitting was performed.

RESULTS AND ANALYSIS

Engagement Depending on Course Position

As shown in the course syllabus (**Table 1**), each week had a unique set of learning materials assigned to it. In general, the material associated with the early teaching weeks were accessed by a greater number of students over the course duration relative to the material associated with the later teaching weeks (**Figure 2**). In addition to this slight reduction in engagement with the online material with position in the course (**Figure 2**), it can be seen that very few students went back to check their answers to the practical activities.
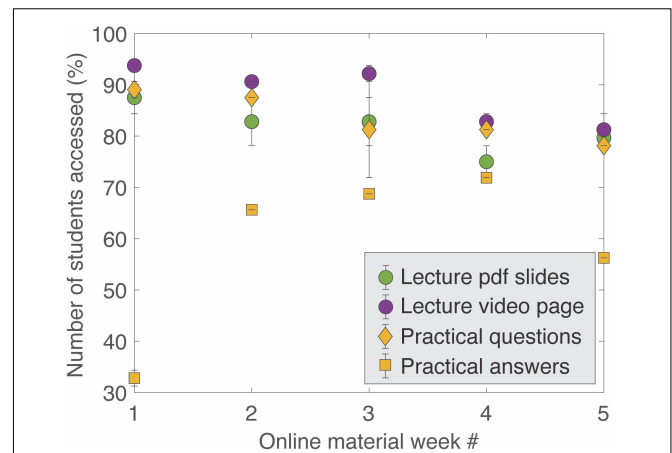
FIGURE 2 | The proportion of students accessing the material provided on the virtual learning environment. The online material has been split per week, as detailed in the course syllabus (**Table 1**). Green circles represent the lecture slides in pdf format, purple circles represent the pages hosting the lecture videos, yellow diamonds represent the practical questions, and the yellow squares represent the answers to the practical exercises. Data points show the mean values, the error bars indicate the minimum and maximum values recorded.

Bulk Attendance and Access Data

Synchronous session attendance and the proportion of online page views can be compared to the students' grades, used here as a proxy for academic performance. Comparisons were made for both assessment types; the volcanology quiz (**Figure 3A**) and the volcanology essay (**Figure 3B**) and for the final aggregated grade (**Figure 3C**) assuming an equal weighting between the essay and the quiz. No positive or negative correlations are observed between attendance/ total page views and performance.

Time Series of Student Access

Student viewing and access data from the virtual learning environment, Canvas, also allows for the monitoring of student engagement with the online material as a function of time, rather than the bulk, course averaged data previously presented. The course was published on Canvas one week before teaching began (i.e., week 0) and included all the teaching material for week 1. Subsequent material was published on the Monday of the related teaching week. The material for week 1 received a small number (43) of views in the week before teaching began (**Figure 4A**). In teaching week 1 there was the second highest number of views (783), this gradually declined to reach a minimum (461) in week 3 before rising again in weeks 4 and 5. Week 6 experienced the highest number of views (1,046), although this week contained no new teaching material or timetabled synchronous sessions it hosted the volcanology quiz, which contributed to the final course grade obtained by the students. These views were dominated by pdf versions of the lecture slides, followed by the practical materials, followed lastly by the pages with the asynchronous lecture videos embedded. After the volcanology quiz in week 6 only a very small number of views (<40) occurred each week, and weeks 11 and 12 received zero views. Engagement rapidly

FIGURE 3 | Relationships between student attendance and performance. The blue circles represent synchronous attendance during online guest lectures, practical sessions, and Q&A sessions. The green squares represent the virtual learning environment page views, normalized to the maximum number of page views recorded for an individual student. No correlations between attendance and student grade (a measure of performance) are observed for any of the assessments. The figure panels show **(A)** the quiz grade, **(B)** the exam essay grade and **(C)** the overall volcanology grade.

increased the week before the final essay-based exam and reached 582 views in week 17 when the final exam was due. These views in weeks 16 and 17 were dominated by the embedded lecture videos and pdf copies of the slides.

The time series of engagement/access to the online material can also be tracked for individual students, two examples are shown in **Figure 4B**. These data allow for interpretations to be made about student study style (e.g., intense "cramming" before examinations vs. sustained learning) and can be used by institutions for wellbeing checks (e.g., identifying sudden reductions in online engagement). The mean number of page views per week shows no correlation to the overall volcanology grade obtained by the student (**Figure 4C**). There is also no correlation between the volcanology quiz grade and the mean

weekly page views within the first 6 weeks (**Figure 4D**). The standard deviation of weekly page views across both time frames (**Figures 4C,D**) can be linked to the study/viewing approach taken by the student. A small standard deviation indicates that the student regularly engaged with the online material on a weekly basis. Whereas a large standard deviation is indicative of uneven access to the online materials. The most common pattern observed was very little, to no engagement with the VLE until one or two weeks before the quiz and exam when activity rapidly increased. Over both time periods (**Figures 4C,D**), there is no correlation between standard deviation of views and academic performance (i.e., grade). Thus, these data do not provide evidence that support a preferred or optimum study plan.

Asynchronous Lecture Viewing Statistics

For each of the embedded lecture videos the portion of the video that was watched at least once was quantified for each student. An example of these data is shown in **Figure 5A**. This shows a typical pattern where the number of students viewing the video decreases with duration into the pre-recorded lecture. There were several students that accessed the VLE page that hosted the video, but did not watch the video in full, or in some cases did not watch any parts of the video. This illustrates the difference between simple page access data (e.g., **Figure 4**) and asynchronous lecture viewing statistics (**Figure 5**). To determine if video views are reflected in student performance, the portion of videos watched across the entire volcanology course (i.e., Lecture 1.1–5.2; **Table 1**) were calculated for each student. **Figure 5B** compares the total proportion of asynchronous lecture videos watched to the overall course grade obtained by the student. In general, there is a positive correlation between the proportion of the asynchronous lecture videos watched by the student and their overall course grade. However, for some students there is no correlation, despite watching all the videos in full they still achieved a low grade. To normalize these results, the student grades were compared to their average grade during the first 2 years of undergraduate study, termed the "grade difference" here (**Figure 5C**). Similarly, a weak positive correlation can be observed, where the students that watched more of the videos, in full, obtained a better grade relative to their personal average.

DISCUSSION AND PERSPECTIVES

Attendance in a Purely Online Environment

During traditional on-campus, in-person delivery attendance is frequently monitored using registers. This is done for multiple reasons, including, but not limited to, government reporting requirements, the link between attendance and academic performance, and pastoral care (Friedman et al., 2001; Macfarlane, 2013; Oldfield et al., 2019). Where a sudden reduction in attendance can be related to concerns over student wellbeing and student drop-out (Smith and Beggs, 2002; Boulton et al., 2019). The use of technology such as in-class quizzes or the use of personal response systems (e.g., "clickers") can reduce the burden of collecting attendance data (Hoekstra, 2008) and
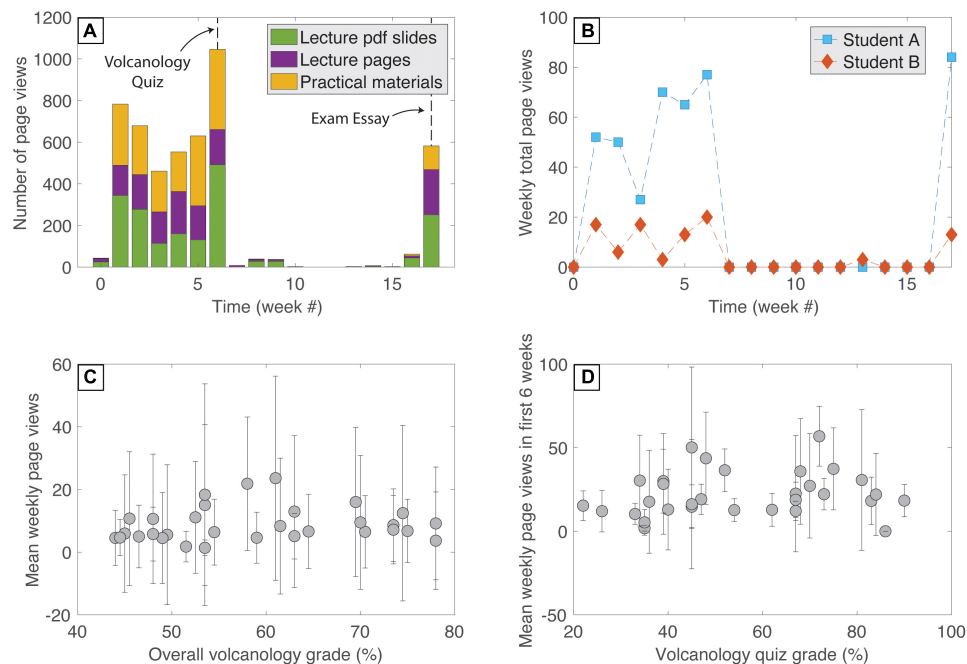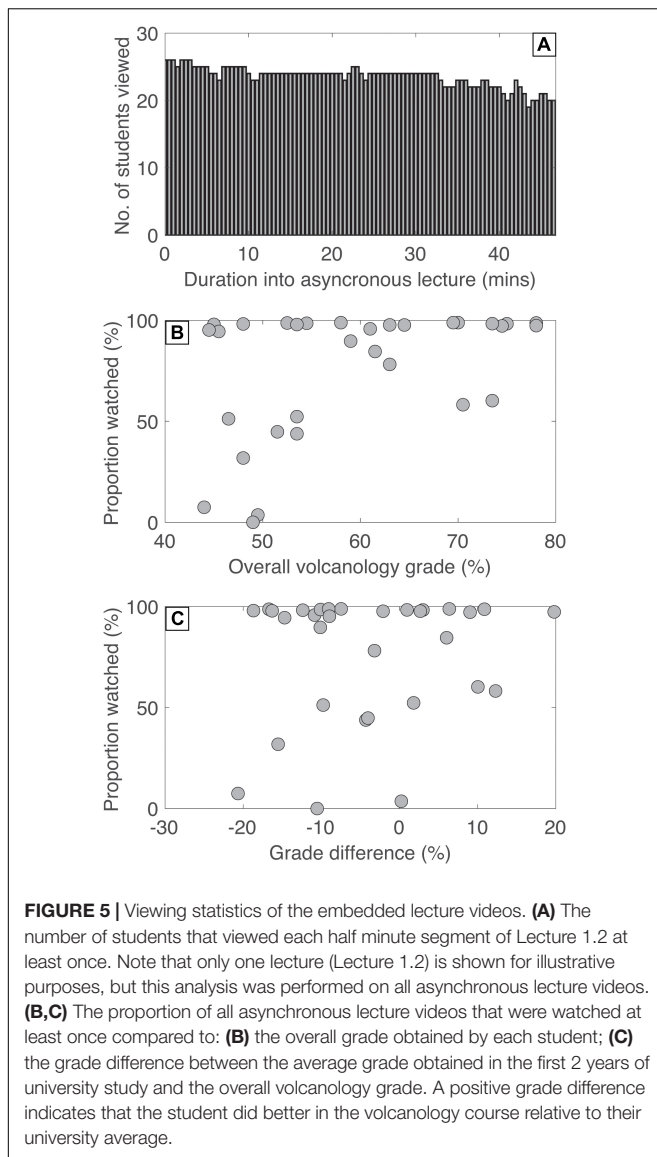
FIGURE 4 | Time series of VLE access. **(A)** The total number of page views per week. The green shaded parts of the bar correspond to the pdf copies of the lecture slides. Purple corresponds to the VLE pages with the lecture video embedded and yellow corresponds to the practical question sheets and answers. Teaching began in week 1 and lasted for 5 weeks, the volcanology quiz was conducted in week 6 and the final essay-based exam was conducted in week 17. **(B)** Total number of page views as a function of week for two representative students. **(C)** Mean number of weekly page views compared to the overall volcanology grade obtained. **(D)** Mean number of weekly page views during weeks 1 through 6 compared to the volcanology quiz grade obtained. In both panels **(C,D)** the error bars represent one standard deviation of the student's page views for weeks 0–17 and for weeks 1–6, respectively.

when the responses are used to constitute part of the course grade they can provide an additional incentive for students to attend. Furthermore, these approaches introduce a component of active learning into an otherwise passive lecture (Gauci et al., 2009). Presenting students with clicker questions part-way through a lecture, for example, requires the learners to actively engage with the lecture material and apply their knowledge. When answers are subsequently presented it offers the students immediate feedback. The incorporation of active learning in this way is widely accepted to be beneficial to both student learning and experience (Froyd, 2007; Freeman et al., 2014). Furthermore, active learning increases student engagement during sessions which has also been shown to increase student performance (e.g., Handelsman et al., 2005; Kuh et al., 2008; Casuso-Holgado et al., 2013; Ayala and Manzano, 2018; Vizoso et al., 2018; Büchele, 2021). Thus, it is not just simple attendance that matters, the level of student engagement is also a key contributing factor.

However, effectively monitoring attendance and engagement and incorporating active learning into online delivery represents a key challenge faced during the rapid changes brought about by the COVID-19 pandemic (Andrews, 2021; Gribble and Wardrop, 2021; Symons, 2021). During online synchronous activities online equivalents to clickers can be used such as Zoom polls or polls based on web browsers. During online synchronous activities I suggest that documenting poll responses might be the best way to accurately register attendance. The use of digital bulletin or

ideas boards such as Padlet can also facilitate student engagement online and have been shown to enhance cognitive engagement and learning (Ali, 2021; Gill-Simmen, 2021). Breakout rooms in video conferencing software such as Zoom or Microsoft Teams and the use of private channels in Microsoft Teams can encourage engagement and discussion between group members (Corradi, 2021; McMenamin and von Rohr, 2021). However, all these approaches require an additional, often large, time investment by the instructor. This was particularly difficult in the early stages of the pandemic when we all had to rapidly adjust to a new way of working. A quick way to monitor attendance during online synchronous delivery is to simply take a register of the attendees signed into the video conferencing software of choice (e.g., Zoom, WebEx, Microsoft Teams). This was the approach taken in this study; however, this does not necessarily constitute attendance and certainly cannot measure engagement. This may, at least in part, explain the lack of correlation observed here (**Figure 3**). The student could easily log on at the start of the synchronous session and then not watch the session. For example, it would be easy to mute the volume, perform other work on another device, or even leave the room. Indeed, from personal experience it is common for a small number (1 or 2 students) to remained logged on, with video cameras turned off, and not participate/engage with the material delivered. If the session ended a few minutes early, directed conversation toward these students clearly revealed that they were not listening or engaged

FIGURE 5 | Viewing statistics of the embedded lecture videos. **(A)** The number of students that viewed each half minute segment of Lecture 1.2 at least once. Note that only one lecture (Lecture 1.2) is shown for illustrative purposes, but this analysis was performed on all asynchronous lecture videos. **(B,C)** The proportion of all asynchronous lecture videos that were watched at least once compared to: **(B)** the overall grade obtained by each student; **(C)** the grade difference between the average grade obtained in the first 2 years of university study and the overall volcanology grade. A positive grade difference indicates that the student did better in the volcanology course relative to their university average.

with the session despite "attending." Instructors should therefore use caution when documenting attendance in this way. One potential solution to this is to encourage students to turn their video cameras on, however, it is good practice not to enforce this because of the associated issues surrounding privacy invasion, inclusivity, and the access to stable internet connections (Darici et al., 2021). The instructor could explain to the students the benefits of video vs. purely audio interaction and allow the students to make their own informed decision.

Monitoring attendance and engagement during online asynchronous activities proves even more challenging. One method, as performed in this study, is to monitor student engagement with the VLE platform. A growing number of educational institutions are tracking student log in to the VLE platform to identify drops in access. Student support services can then follow up with individual students and offer further support and pastoral care as required. Despite being a quick

and convenient method of quantifying online engagement, documenting the number of page views does pose challenges. Students may go through clicking on many pages on the VLE without properly reading or digesting the material, they may also download the material (e.g., lecture slide pdfs) and view them offline, rather than within the VLE browser. These caveats limit the use of VLE page viewing statistics as an appropriate metric for assessing online student engagement (cf. **Figures 3**, **4**). This therefore questions the value and time investment spent collecting these data by instructors and administrative teams.

Effective Monitoring of Attendance Through a Virtual Learning Environment

In this study I have shown that these synchronous attendance data and the VLE page viewing statistics do not show any measurable relationship to student performance. Some key reasons for this lack in correlation have been detailed above. The only metric that showed some correlation to student performance was the proportion of the asynchronous lecture videos viewed (**Figure 5**). The results are broadly in line with studies of physical attendance during in-person delivery where the correlation is positive—increased attendance increases student performance (e.g., Jones, 1984; Launius, 1997; Rodgers, 2001; Sharma et al., 2005; Marburger, 2006). The proportion of video viewed by each student is therefore a better way of measuring "attendance" relative to simple page views. Although it is impossible to determine if the student was truly listening tentatively to the asynchronous lecture video, at the very least it can be determined that: (a) it was played and (b) for what specific duration. For example, I observed that a small number of students (<5) sometimes viewed a page that hosted the embedded lecture video but never watched the video. Furthermore, the metric is more robust against students trying to falsely register attendance—if another tab is opened within the web browser the VLE does not record this time as viewing. Therefore, this level of analysis can also provide some benefits over synchronous online lectures given to participants without webcams enabled. Due to these multiple factors, I suggest that video viewing statistics offer the best way to monitor "attendance" during online, asynchronous delivery.

Lessons Learnt for Providing Online Materials

There is debate within the literature surrounding what constitutes an ideal virtual learning environment, however, it is broadly agreed that building good instructor-student relations, motivating students to do their best, and increased interpersonal interaction are most beneficial (e.g., Fredericksen et al., 1999; Young, 2006; Jaggars and Xu, 2016). Additionally, some studies suggest that the exact layout and structure of the material provided on the VLE platform may not directly influence student performance (Jaggars and Xu, 2016). Here, I do not evaluate the role of the VLE layout on performance, rather, I provide a perspective on useful VLE layouts for effective monitoring of student "attendance" and "engagement."

Separating out different course content (e.g., scientific topics) and components (e.g., practical exercises, lectures), each on a unique, separate VLE page allows for a more detailed level of engagement analysis. This is more useful than bulk access data, used to determine whether an individual student has logged into the VLE platform or not. Although I have shown that page viewing data does not show any direct, measurable relationship to student performance, these individual page viewing data can have benefits. Now, I provide three examples of how separate VLE pages and their associated access data might be useful.

First, separating out the solutions/answers to practical exercises from the question sheets allows the instructor to determine the proportion of students that are checking their answers, forming a key component of knowledge consolidation. The instructor or student support teams may then choose to approach students who are less engaged with these online materials to ascertain why and provide further support as appropriate. Second, providing the recommended reading or links to this material on a separate VLE page allows the instructor to determine the number of students further supporting their learning outside of the timetabled activities. Third, providing lecture slides in addition to the asynchronous recording is often considered good practice to facilitate different learning types (e.g., Auditory vs. reading) (Fleming, 1995). Again, separating these out on different VLE pages allows the instructor to quantitatively assess the proportion of students who read, listen or both read and listen to the lecture material. This also allows the students to tailor their study method to their own personal learning style or circumstance (e.g., internet bandwidth too low for video streaming).

However, these suggestions of restructuring VLE layouts and the associated monitoring student access data present a large additional time investment by the instructor. Given the lack of correlation between total page views and student performance reported here it is not recommended that such statistics are routinely monitored. Rather, as detailed in the examples above, instructor time should be invested in monitoring VLE engagement to address specific questions (e.g., what proportion of students are checking their answers to in-class exercises?). Furthermore, for these data to be useful, additional resources are required to interact, support and/or encourage those students who show limited engagement. Lastly, all these online VLE monitoring approaches are prone to student manipulation. Once students know what statistics (e.g., page clicks, video views) are being monitored it is easy to "cheat the system" and falsify the data. Instructors should therefore be careful about regularly reminding students that such data is being monitored.

Limitations and Future Work

A limitation of this work is the small sample size used. Only 31 students, in one undergraduate course participated in this study and a clear avenue for future work would be to test these results and perspectives on a larger sample set featuring a diverse group of students, studying a range of subjects over multiple academic years. In this study the video viewing data extracted from the VLE, Canvas, did not quantify the number of times each student viewed the asynchronous lecture video—just whether

a time segment had been viewed at least once. Upgrading the viewing statistics code within the VLE would allow us to test if the number of views influences student performance. Furthermore, the VLE cannot capture data on whether students work together when they study. The VLE will only log one student as accessing a resource, even if there were a group in the room watching the recording together. Given the COVID-19 restrictions in place when this course was taught, group VLE accesses are unlikely here but should be considered in future studies.

This study is built upon the premise that the lecture and practical materials addressed learning objectives that were subsequently tested in the assessments to determine a student's grade. This has traditionally been the case where the timetabled activities directly contribute to the learning objectives. In these cases, the link between attendance and student performance is relatively straightforward. However, with our growing transition to a hybrid or blended learning model where timetabled activities can comprise, for example, open discussion forums, flipped classrooms and student seminars, the link between (online) attendance and performance could be further complicated. It will be difficult to isolate the impact of increased attendance from the other benefits provided by a blended learning model (e.g., McFarlin, 2008; Al-Qahtani and Higgins, 2013). Despite this, the key message here remains true. Simple VLE log in or page viewing is not sufficient to determine student attendance and engagement and with our ever-increasing use of online materials this must be reconsidered.

SUMMARY AND CONCLUSION

In this study it has been shown that attendance during online synchronous activities and the number and frequency of VLE page views do not clearly correlate with student performance. This is in contrast with numerous studies (e.g., Jones, 1984; Launius, 1997; Rodgers, 2001; Sharma et al., 2005; Marburger, 2006; Büchele, 2021) that have demonstrated a positive relationship between increased in-person attendance and student grades (a proxy for performance). The reasons behind the disconnect between attendance and performance in an online, vs. in-person setting are complex and comprised of numerous inter-related factors. The ease of falsely registering attendance online (e.g., logging into Zoom and muting the volume) and the unknown level of engagement (e.g., clicking on VLE pages but not reading the content) are key examples. Given that basic VLE access statistics (e.g., number of page views/clicks) show no measurable relationship to performance, we need a better method to monitor attendance and engagement in an online setting. This is a key pedagogical implication of this research and one that requires further investigation.

One method that has shown some promise is the use of asynchronous lecture video viewing statistics. Specifically, the total proportion of the videos watched by a student has been shown to be weakly correlated with performance. However, this is unlikely to be the full solution. Obtaining and analyzing these data requires a considerable time investment by the instructor which might not be possible for all courses. Furthermore, the

exclusive use of lecture viewing data assumes that all the learning objectives are met in this manner. It is not robust against courses where all (or a portion) of the learning objectives are met through group activities, flipped classroom sessions, or in-person laboratory tasks, for example. Looking forward we must ascertain what methods are appropriate for accurately monitoring attendance and engagement in an online and hybrid teaching model. This requires careful investigation and as a community we should be cautious when using bulk, yet easily obtainable, VLE access data.

DATA AVAILABILITY STATEMENT

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author/s.

ETHICS STATEMENT

This study was approved by the University of Liverpool's ethics committee. Before any of these data used in this study were collected an email was sent to all students. The email informed the students about the use of these data to be collected and gave the students an option to opt out of the study. No students opted out. For all data, immediately after collection, all student names were removed and each student was assigned a random number between 1 and 31 such that these data remained truly anonymous and could not be deduced by the alphabetical order of surnames, for example. No other identifying characteristics were ever collected. Written informed consent for participation was not required for this study in accordance with the national legislation and the institutional requirements.

AUTHOR CONTRIBUTIONS

TJ led all parts of the study, from project conceptualization to manuscript writing and submission.

ACKNOWLEDGMENTS

REFERENCES

Ali, A. (2021). Using Padlet as a Pedagogical Tool. *J. Learn. Dev. High. Educ.* 2021:799. doi: 10.47408/jldhe.vi22.799

Al-Qahtani, A. A. Y., and Higgins, S. E. (2013). Effects of traditional, blended and e-learning on students' achievement in higher education. *J. Comput. Assist. Learn.* 29, 220–234. doi: 10.1111/j.1365-2729.2012.00490.x

Andersen, C. B. (2002). Understanding carbonate equilibria by measuring alkalinity in experimental and natural systems. *J. Geosci. Educ.* 50, 389–403. doi: 10.5408/1089-9995-50.4.389

Andrews, J. (2021). Transition online: challenges and achievements. *J. Learn. Dev. High. Educ.* 2021:703. doi: 10.47408/jldhe.vi22.703

Ayala, J. C., and Manzano, G. (2018). Academic performance of first-year university students: The influence of resilience and engagement. *High. Educ. Res. Dev.* 37, 1321–1335. doi: 10.1080/07294360.2018.1502258

Baldock, T. E., and Chanson, H. (2006). Undergraduate teaching of ideal and real fluid flows: the value of real-world experimental projects. *Eur. J. Eng. Educ.* 31, 729–739. doi: 10.1080/03043790600911837

Boulton, C. A., Hughes, E., Kent, C., Smith, J. R., and Williams, H. T. P. (2019). Student engagement and wellbeing over time at a higher education institution. *PLoS One* 14:e0225770. doi: 10.1371/journal.pone.0225770

Büchele, S. (2021). Evaluating the link between attendance and performance in higher education: the role of classroom engagement dimensions. *Assess. Eval. High. Educ.* 46, 132–150. doi: 10.1080/02602938.2020.1754330

Casuso-Holgado, M. J., Cuesta-Vargas, A. I., Moreno-Morales, N., Labajos-Manzanares, M. T., Barón-López, F. J., and Vega-Cuesta, M. (2013). The association between academic engagement and achievement in health sciences students. *BMC Med. Educ.* 13, 1–7. doi: 10.1186/1472-6920-13-33

Chung, J., McKenzie, S., Schweinsberg, A., and Mundy, M. E. (2022). Correlates of Academic Performance in Online Higher Education: a Systematic Review. *Front. Educ.* 7:820567. doi: 10.3389/feduc.2022.820567

Clump, M. A., Bauer, H., and Whiteleather, A. (2003). To attend or not to attend: Is that a good question? *J. Instr. Psychol.* 30, 220–224.

Colorado, J. T., and Eberle, J. (2012). Student demographics and success in online learning environments. *Emporia State Res. Stud.* 46, 4–10.

Corradi, H. R. (2021). Does Zoom allow for efficient and meaningful group work? Translating staff development for online delivery during Covid-19. *J. Learn. Dev. High. Educ.* 2021:697. doi: 10.47408/jldhe.vi22.697

Credé, M., and Kuncel, N. R. (2008). Study habits, skills, and attitudes: the third pillar supporting collegiate academic performance. *Perspect. Psychol. Sci.* 3, 425–453. doi: 10.1111/j.1745-6924.2008.00089.x

Credé, M., Roch, S. G., and Kieszczynka, U. M. (2010). Class attendance in college: a meta-analytic review of the relationship of class attendance with grades and student characteristics. *Rev. Educ. Res.* 80, 272–295. doi: 10.3102/0034654310362998

Darici, D., Reissner, C., Brockhaus, J., and Missler, M. (2021). Implementation of a fully digital histology course in the anatomical teaching curriculum during COVID-19 pandemic. *Ann. Anatomy-Anatomischer Anzeiger* 236:151718. doi: 10.1016/j.aanat.2021.151718

Farrell, J. J., Moog, R. S., and Spencer, J. N. (1999). A guided-inquiry general chemistry course. *J. Chem. Educ.* 76:570. doi: 10.1021/ed076p570

Fleming, N. D. (1995). "I'm different; not dumb. Modes of presentation (VARK) in the tertiary classroom," in *Research and development in higher education, Proceedings of the 1995 Annual Conference of the Higher Education and Research Development Society of Australasia (HERDSA)*, (HERDSA), 308–313. doi: 10.1016/j.nedt.2008.06.007

Fredericksen, E., Swan, K., Pelz, W., Pickett, A., and Shea, P. (1999). Student satisfaction and perceived learning with online courses-principles and examples from the SUNY learning network. *Proc. ALN Sum. Workshop* 1999:1999.

Freeman, S., Eddy, S. L., McDonough, M., Smith, M. K., Okoroafor, N., Jordt, H., et al. (2014). Active learning increases student performance in science, engineering, and mathematics. *Proc. Natl. Acad. Sci.* 111, 8410–8415. doi: 10.1073/pnas.1319030111

Friedman, P., Rodriguez, F., and McComb, J. (2001). Why students do and do not attend classes: Myths and realities. *Coll. Teach.* 49, 124–133. doi: 10.1080/87567555.2001.10844593

Froyd, J. E. (2007). Evidence for the efficacy of student-active learning pedagogies. *Proj. Kaleidosc.* 66, 64–74.

Gauci, S. A., Dantas, A. M., Williams, D. A., and Kemm, R. E. (2009). Promoting student-centered active learning in lectures with a personal response system. *Adv. Physiol. Educ.* 33, 60–71. doi: 10.1152/advan.00109.2007

Giles, S., Jackson, C., and Stephen, N. (2020). Barriers to fieldwork in undergraduate geoscience degrees. *Nat. Rev. Earth Environ. Environ.* 1, 77–78. doi: 10.1038/s43017-020-0022-5

Gill-Simmen, L. (2021). Using Padlet in instructional design to promote cognitive engagement: a case study of undergraduate marketing students. *J. Learn. Dev. High. Educ.* 2021, 575. doi: 10.47408/jldhe.vi20.575

Gribble, L., and Wardrop, J. (2021). Learning by engaging: connecting with our students to keep them active and attentive in online classes. *J. Learn. Dev. High. Educ.* 2021:701. doi: 10.47408/jldhe.vi22.701

Gump, S. E. (2005). The cost of cutting class: attendance as a predictor of success. *Coll. Teach.* 53, 21–26. doi: 10.3200/ctch.53.1.21-26

Handelsman, M. M., Briggs, W. L., Sullivan, N., and Towler, A. (2005). A measure of college student course engagement. *J. Educ. Res.* 98, 184–192. doi: 10.3200/joer.98.3.184-192

Hoekstra, A. (2008). Vibrant student voices: exploring effects of the use of clickers in large college courses. *Learn. Media Technol.* 33, 329–341. doi: 10.1080/17439880802497081

Jaggars, S. S., and Xu, D. (2016). How do online course design features influence student performance? *Comput. Educ.* 95, 270–284. doi: 10.1016/j.compedu.2016.01.014

Johnson, G. M. (2015). On-campus and fully-online university students: comparing demographics, digital technology use and learning characteristics. *J. Univ. Teach. Learn. Pract.* 12:4.

Jones, C. H. (1984). Interaction of absences and grades in a college course. *J. Psychol.* 116, 133–136. doi: 10.1080/00223980.1984.9923627

Jones, T. J., and Ehlers, T. A. (2021). Using benchtop experiments to teach dimensional analysis and analogue modelling to graduate geoscience students. *J. Geosci. Educ.* 69, 313–322. doi: 10.1080/10899995.2020.1855040

Kahu, E. R., Stephens, C., Leach, L., and Zepke, N. (2013). The engagement of mature distance students. *High. Educ. Res. Dev.* 32, 791–804. doi: 10.1080/07294360.2013.777036

Knight, J. K., and Wood, W. B. (2005). Teaching more by lecturing less. *Cell Biol. Educ.* 4, 298–310. doi: 10.1187/05-06-0082

Kuh, G. D., Cruce, T. M., Shoup, R., Kinzie, J., and Gonyea, R. M. (2008). Unmasking the effects of student engagement on first-year college grades and persistence. *J. Higher Educ.* 79, 540–563. doi: 10.1353/jhe.0.0019

Launius, M. H. (1997). College student attendance: attitudes and academic performance. *Coll. Stud. J.* 31, 86–92.

Lievens, F., Coetsier, P., De Fruyt, F., and De Maeseneer, J. (2002). Medical students' personality characteristics and academic performance: a five-factor model perspective. *Med. Educ.* 36, 1050–1056. doi: 10.1046/j.1365-2923.2002.01328.x

Macfarlane, B. (2013). The surveillance of learning: A critical analysis of university attendance policies. *High. Educ. Q.* 67, 358–373. doi: 10.1111/hequ.12016

Marburger, D. R. (2006). Does mandatory attendance improve student performance? *J. Econ. Educ.* 37, 148–155. doi: 10.3200/jece.37.2.148-155

McFarlin, B. K. (2008). Hybrid lecture-online format increases student grades in an undergraduate exercise physiology course at a large urban university. *Adv. Physiol. Educ.* 32, 86–91. doi: 10.1152/advan.00066.2007

McMenamin, J., and von Rohr, M.-T. R. (2021). Private online channels and student-centred interaction. *J. Learn. Dev. High. Educ.* 2021:689. doi: 10.47408/jldhe.vi22.689

Mishra, L., Gupta, T., and Shree, A. (2020). Online teaching-learning in higher education during lockdown period of COVID-19 pandemic. *Int. J. Educ. Res. Open* 1:100012. doi: 10.1016/j.ijedro.2020.100012

Oldfield, J., Rodwell, J., Curry, L., and Marks, G. (2019). A face in a sea of faces: exploring university students' reasons for non-attendance to teaching sessions. *J. Furth. High. Educ.* 43, 443–452. doi: 10.1080/0309877x.2017.1363387

Robbins, S. B., Lauver, K., Le, H., Davis, D., Langley, R., and Carlstrom, A. (2004). Do psychosocial and study skill factors predict college outcomes? A meta-analysis. *Psychol. Bull.* 130, 261. doi: 10.1037/0033-2909.130.2.261

Rodgers, J. R. (2001). A panel-data study of the effect of student attendance on university performance. *Aust. J. Educ.* 45, 284–295. doi: 10.2147/AMEP.S226255

Seymour, E., Hunter, A.-B., Laursen, S. L., and DeAntoni, T. (2004). Establishing the benefits of research experiences for undergraduates in the sciences: first findings from a three-year study. *Sci. Educ.* 88, 493–534. doi: 10.1002/sce.10131

Sharma, M. D., Mendez, A., and O'Byrne, J. W. (2005). The relationship between attendance in student-centred physics tutorials and performance in university examinations. *Int. J. Sci. Educ.* 27, 1375–1389. doi: 10.1080/09500690500153931

Smith, E. M., and Beggs, B. J. (2002). "Optimally maximising student retention in Higher Education," in *SRHE Annual Conference*, (Glasgow), 2002. doi: 10.1186/s12960-019-0432-y

Symons, K. (2021). "Can you hear me? Are you there?": student engagement in an online environment. *J. Learn. Dev. High. Educ.* 2021:730. doi: 10.47408/jldhe.vi22.730

Vizoso, C., Rodríguez, C., and Arias-Gundín, O. (2018). Coping, academic engagement and performance in university students. *High. Educ. Res. Dev.* 37, 1515–1529. doi: 10.1080/07294360.2018.1504006

Westerman, J. W., Perez-Batres, L. A., Coffey, B. S., and Pouder, R. W. (2011). The relationship between undergraduate attendance and performance revisited: alignment of student and instructor goals. *Decis. Sci. J. Innov. Educ.* 9, 49–67. doi: 10.1111/j.1540-4609.2010.00294.x

Wieling, M. B., and Hofman, W. H. A. (2010). The impact of online video lecture recordings and automated feedback on student performance. *Comput. Educ.* 54, 992–998. doi: 10.1016/j.compedu.2009.10.002

Young, S. (2006). Student views of effective online teaching in higher education. *Am. J. Distance Educ.* 20, 65–77. doi: 10.1207/s15389286ajde2002_2

Check for
updates

Educational Reforms Amid COVID-19 in Thailand

Wachiraporn Poungjinda[1] and Shubham Pathak[2]*

[1] School of Political Science and Laws, Walailak University, Nakhon Si Thammarat, Thailand, [2] College of Graduate Studies (CGS), Walailak University, Nakhon Si Thammarat, Thailand

Education is essential for any country to secure its future, but COVID-19 has caused considerable difficulty in Thailand. The COVID-19 pandemic harms the education of the students. The online education system is adopted in almost all parts of the globe. However, the pandemic has been impacting the overall quality of the education system. This research explored the experiences of law students in Thailand by analyzing several factors which affect their intellect. The methodology adopted for this study was a multiple method study. The sample size of 330 law students selected from leading Thai universities was analyzed qualitatively through Strength, Weakness, Opportunity, and Threat (SWOT) analysis and regression model for the quantitative analysis. The findings revealed that factors including internet availability, accessibility to own gadgets, online resources, government, social media, and classrooms have a significant impact on the education system of Thai law students. The study paves way for further microanalysis of the educational system in Thailand with the perceptions and experiences of teachers and parents.

Keywords: education, COVID-19, constitutional reforms, Thai constitution, sustainable development

INTRODUCTION

Every child has the right to an uninterrupted education, but COVID-19 has jolted education throughout the globe. Thailand has been growing in the past few decades. The COVID-19 pandemic has brought a jolt to the progress of Thailand (Fry and Bi, 2013). Young minds are facing several challenges in the learning process. The legal framework in Thailand does exist and provides for a quality education system in Thailand. This was adversely affected by the pandemic hitting hard upon education, with inadequate measures adopted at the governance level. Digital technologies have been incorporated at various levels of the Thai education system with an online or hybrid system of teaching and learning processes (Yu and Jo, 2014; Huang et al., 2020).

The Thai constitution provides for the rights, and responsibilities and ensures the adequate functioning of a State. The rights are comprehensive, and each right is related to the overall aspect of the constitution. This study focuses on the experiences of the Thai laws students by analyzing several factors which affect the intellect of the students in Thailand. The analysis was done with the educational advancement to ensure an in-depth understanding and analysis of the gaps within the Thai laws. Several factors provide for collaborative impacts on the Thai population in terms of diminishing their education right including geographical, political, social, environmental, and cultural factors (Laikram and Pathak, 2022).

The government structure in Thailand is not well-defined with monarchy still prevalent. Under the Thai constitution, monarchy is adopted, "Thailand adopts a democratic regime of government with the King as Head of State." (Chapter I, section materials and methods, p. 4). The constitution

in Thailand is being adopted as the supreme law for the State which is headed by the King along with a democratic structure of elected government. Section results of the Thai constitution defines,

"Sovereign power belongs to the Thai people. The King as Head of State shall exercise such power through the National Assembly, the Council of Ministers, and the Courts in accordance with the provisions of this Constitution. The National Assembly, the Council of Ministers, Courts, Independent Originations, and State agencies shall perform duties in accordance with the constitution, laws, and the rule of law for the common good of the nation and the happiness of the public at large." (Chapter I, section results, p. 5).

Accordingly, dual governance poses irregularity in the adequate implementation of the policies. Similarly, public dissatisfaction is prevalent due to the multiple government structure leading to anarchy and chaos during the COVID. The recent decades have seen the military coup in Thailand. These coups result in reduced human rights and international collaboration (Constitution B.E. 2560, 2017). In the years 2006 and 2017, the military coup directly affected the diplomatic collaboration, human rights, and implementation of constitutional laws in Thailand (Kunnamas, 2020).

However, the constitution of Thailand is the epitome of the education framework in Thailand. The constitution protects the rights of the people both in terms of human rights and education laws. The constitution protects the rights of the Thai population, "Human dignity, rights, liberties and equality of the people shall be protected. The Thai people shall enjoy equal protection under this Constitution (Chapter I, section discussion, p. 4)."

The constitution is the prime legal document that governs the Thai social, economic, and education systems. The constitution is unofficially translated into the English language by the office of the council of the state, however, the translated document provides for accurate policies and implications of the sections of the constitution.

"The Constitution is the supreme law of the State. The provisions of any law, rule or regulation, or any acts, which are contrary to or inconsistent with the Constitution, shall be unenforceable. Whenever no provision under this Constitution is applicable to any case, an act shall be performed or a decision shall be made in accordance with the constitutional conventions of Thailand under the democratic regime of government with the King as Head of State. (Chapter I, section conclusion)."

There have been many incidents and unfortunate events in the past which adversely affected the Thai population's educational rights. The inadequate capacities of the government channels to aptly implement the stated rules and regulations among the policies and ordinances at the school and university level results in adverse effects upon the rights of the people. The well-defined structure does pave way for an adequate educational framework in the country. However, several factors, as discussed in the research, curtail the proper adaption of all the written legal policies and ordinances at the local levels of governance in Thailand.

Constitution has been drawn from the French word "constituer" signifying to build or construct. The constitution defines the rules and regulations of a State. The basic governance is through the various articles and sections of the Constitution. The constitution of the Kingdom of Thailand has been amended between 1974, and 1997 and the current version is from 2017. The major governing body remains to be government, however, with several incidences of the military coup and political instabilities the Thai people suffer from diminished and ineffective legal rights. Thailand revised the educational reforms in 1999 with the adoption of a learner-centered approach, however, a lack of reforms was found after the pandemic (Connors, 1999; Tongpoon-Patanasorn, 2011). The situation of legal protection is declining due to the global COVID-19 pandemic.

Thailand is equipped with the Thai education laws in the constitution (Article 54 and 250) as well as the National Education Act of B.E. 2542 (1999) which defines education as the right of all Thai people (Article 6). However, these have become redundant due to the COVID-19 pandemic due to changing scenario of education dissemination procedures (Dwivedi et al., 2020). The non-equipped students are not able to receive their right to education due to several factors arising due to COVID-19 implications (Hussain et al., 2020). The local administrative guidelines (Article 250) in the constitution do provide for quality education, however, implementation is lacking at the local levels of Thailand. Thus, it becomes essential to review these sections to provide for the COVID-19 pandemic scenario.

Thailand has been struggling in terms of educational rights and legal freedom due to the COVID-19 pandemic and the revolutionary youth movement in 2020. However, the constitutional law does not provide for the protection of the education rights and other rights of the dissatisfied population. The rights suspended by Prime Minister Gen. Prayut Chan-Ocha's policies and governmental ordinances including the freedom of expression and arbitrarily arrested resulted in the enhancement of the revolution in Thailand.

Thailand has various streams of education provided by leading and world-ranked universities (Wintachai et al., 2021). The National Educational ACT was implemented in 1999 in Thailand (Kantavong and Nethanomsak, 2012) however, with the new normal scenario due to COVID-19, the government is required to implement reforms. The Thai students are known to be humble, respectful as well as critical in their approach to education. Thai Law students are more inclined toward the implication of the educational system and reform required to enhance educational rights (Mujtaba et al., 2010).

The Commission of Higher Education (CHE) is working under the Ministry of Education toward educational reforms and providing higher standards for the education system in Thailand. The CHE regulates both public as well as private universities through the Office of National standards and quality assessment, National Institute of Educational Testing Services, and Science and Technology Postgraduate Education and Research Development Office under the second 15 year long-range plan on higher education as guided by the Ministry of Education. The Times Higher Education QS World Universities Ranking (THE-QS), and Shanghai Jiao Tong University Global Ranking (SJTU) are adopted by several Thai universities to

ensure the quality of education. However, the ground-level implications lack in the implementation of these regulations.

Therefore, this study aimed to identify, understand, and analyze the various factors that are to be included in the educational reforms through the amendments in the legal framework and constitution to provide for sustainable development and ensure educational rights to all in Thailand. The explicit research questions are as follows:

- What are the various factors directly affecting the educational rights of Thai law students?
- What is the relationship between selected factors to ensure high levels of legal framework and rights of Thai students?
- Which stakeholders are required to adapt and implement the legal framework, policies, and enhanced educational rights of Thai law students?

Educational rights are essential to ensure quality education for all. Thailand has been struggling in terms of the educational measures to be implemented during the COVID-19 pandemic among the universities. The stress of balancing the education quality as well as financial resources resulted in mismanagement and an unbalanced approach toward education framework and regulatory policies since 2020. This study would provide the direction and research-based strategies toward enhanced and effective education rights. The immediate beneficiaries will be the students and universities; however, the long-term beneficiary would be the Thai economy and legal system.

MATERIALS AND METHODS

The methodology adopted for this study is a multiple method study. The study area was selected among the leading Thai public universities with an emphasis on law degree programs (Woodrow, 2014). The university was selected based on both public-private stakeholders involved with the law degree program in Thailand and equipped with educational reforms and mock court experiences among the students. The sample size of 330 law students was selected from a leading Thai university. The sampling technique of random purposive sampling was adopted to ensure the self-interest and learning process among students. The students were among the regular students who are pursuing their bachelor's degrees.

The data was collected through a survey questionnaire and key informant interviews. The survey questionnaire was shared among the law students to understand their perception and experiences education system in Thailand. The survey questionnaire provided the detailed demographic, perceptions, and needs of the law students. The key informants were selected among the students, teachers, and parents who were directly affected by the COVID-19 pandemic to ensure the detailed experiences and understanding of law degree programs and the implications of the COVID-19 pandemic's effects on educational rights. The database was collected from the university and then respondents were selected randomly along with their acceptance to be key informants and respondents. The gaps, requirements, and offers from the educational framework in Thailand have

been extensively discussed and recorded throughout the data collection phase. The respondents were asked about their experiences, perceptions, understanding, and interpretations of the education system in Thailand, especially with the enhanced vulnerabilities of the COVID-19 pandemic.

The collected data was analyzed qualitatively through Strength, Weakness, Opportunity, and Threat (SWOT) analysis and regression model for the quantitative analysis. The strength, weakness, opportunity, and threats analysis provided for the understanding of the factors and stakeholders' role in the educational reform in Thailand (Helms and Nixon, 2010). The SWOT analysis provides for the strategic measures to be adopted by analyzing the current scenario of the educational reforms in Thailand with inclusive governance opportunities within the existing legal framework (Learned et al., 1969; Cohen et al., 2017). This provided for the results sections and provided the ground level findings toward the policy level recommendation through this research.

The quantitative analysis involved the backward regression model which analyses and eliminated the insignificant factors to provide for the significant factors (Yu and Jo, 2014). Several independent factors including the internet availability, accessibility of own gadgets, law study, online resources government, social media, and hybrid classrooms were analyzed with the dependent factor of educational reform. These factors were selected based on previous literature and the COVID-19 impacted the educational sector in Thailand (Ali, 2020; Ferri et al., 2020; Adarkwah, 2021).

RESULTS

The results included both quantitative and qualitative analysis. The collected data provided the real experiences, perceptions, and attitudes of stakeholders toward the education sector. The findings revealed that factors including internet availability, accessibility to own gadgets, online resources, government, social media, and hybrid classrooms have a significant impact on the education of Thai law students.

Internet availability is one of the major concerns for most Thai law students. The absence of internet in far-flung areas or remote locations results in disruptive classroom sessions. The students complained about the internet speed affecting their learning capacities (Kew, 2018). Similarly, accessibility of own gadgets such as laptops and i-pads at their home resulted in diminished productivity for their lessons, assignments, and overall learning process.

Students found it difficult to access online resources due to the first two factors i.e., internet availability, and accessibility to own gadgets. The students in Thailand are adaptable to these changes (Teo, 2014), however, the lack of government assistance, the online classroom system was found to be ineffective. Social media is impacting the studies of the student as a resource whereas the hybrid classroom was found to be inadequate as teachers were not able to teach and include all the students at the same time.

Table 1 shows the association between demographics and educational reform. From **Table 1** it was noticed that the men

TABLE 1 | Demographics for the educational reform.

Demographics	Age limit	Total population	Z score	P
Age	18–25	330	1.230	0.120
Gender	Female	150	3.965	0.000*
	Male	180		
Married/unmarried	Married	50	1.204	0.035
	Un-married	280		
Level of education	BS students	330	3.205	0.000*
Education Discipline	Law	330	2.569	0.000*

*P < 0.005.

TABLE 2 | Correlation among proposed variables.

	Educational reform
Internet availability	−0.882***
Accessibility of own gadgets	0.665***
Law study	−0.068
Online resources	0.556***
Government	0.598***
Social media	0.963***
Hybrid classroom	0.889***

***Correlation is significant at p < 0.01.

TABLE 3 | Backward multiple regression analysis.

Factors	Value
Internet availability	−0.382**
Accessibility of own gadgets	0.365**
Law study	0.048
Online resources	0.384**
Government	0.328**
Social media	0.163*
Hybrid classroom	0.389**
F-Statistics	16.895**
Adjusted R-Square	0.652

**Significant at 0.05.
*Significant at 0.1.

are found more inclined toward reforms than women. Similarly, unmarried demographics have been more profound toward educational reforms than married ones. For this study, the data was collected from the students enrolled in the law studies domain under the age of 18–25 which was not separately tested under different age groups.

The results of **Table 2** show that educational reform is strongly related to internet availability, accessibility to own gadgets, online resources, government, social media, and hybrid classrooms in the context of law students. But the law study has not been found as related to educational reforms. The results are supporting the previous findings from the researchers.

The educational reforms are depending upon government initiatives which were found to be limited in Thailand. Both students and government bodies have no common platform to provide for the required necessities. This was one of the major hurdles to bringing about needed reforms at the policies levels due to inadequate political interventions.

As suggested by previous authors, the backward regression method was used to remove the insignificant factors from the proposed research model. The results are presented in **Table 3**. The p-value for the F-statistics of the proposed model is significant at the level of 0.005. The model has the F = 16.895, $p < 0.005$, $R^2 = 0.652$. Meanwhile, it was noticed that the proposed variables for the theoretical model are related to educational reform. As the results indicated except for law study all of the proposed factors are the factor responsible for the educational reform.

These results indicate the need for the educational reforms required at the local level of governance in Thailand. The educational system is robust; however, it is essential to revise the policies to enhance the overall effectiveness of the education system. The quantitative results were supported by the qualitative results which were collected through the key respondent interviews. The qualitative findings focused on the overall scenario of the COVID-19 pandemic impacting the education environment, stakeholders, and what are the possible reforms that are essential to adopt to provide for sustainable development in Thailand.

Strength, weakness, opportunity, and threat analysis provides for the analysis of the significant factors along with the political, social, and technological environment of the educational system in Thailand (Refer **Figure 1**). The strategies and measures to be adopted in terms of the adoption of educational rights during and after the COVID-19 pandemic are to be designed inclusive of the SWOT analysis. The analysis was dependent upon the informant interviews which provided for the experiences and perceptions of the study respondents.

Strengths

Thailand boasts of a robust legal framework with well-defined rules and regulations; however, the ground-level implementations are found to be limited (Sanjaiprom, 2021). The constitution is comprehensive and covers almost every aspect

FIGURE 1 | Strength, Weakness, Opportunity, and Threat (SWOT) Analysis toward education system in Thailand.
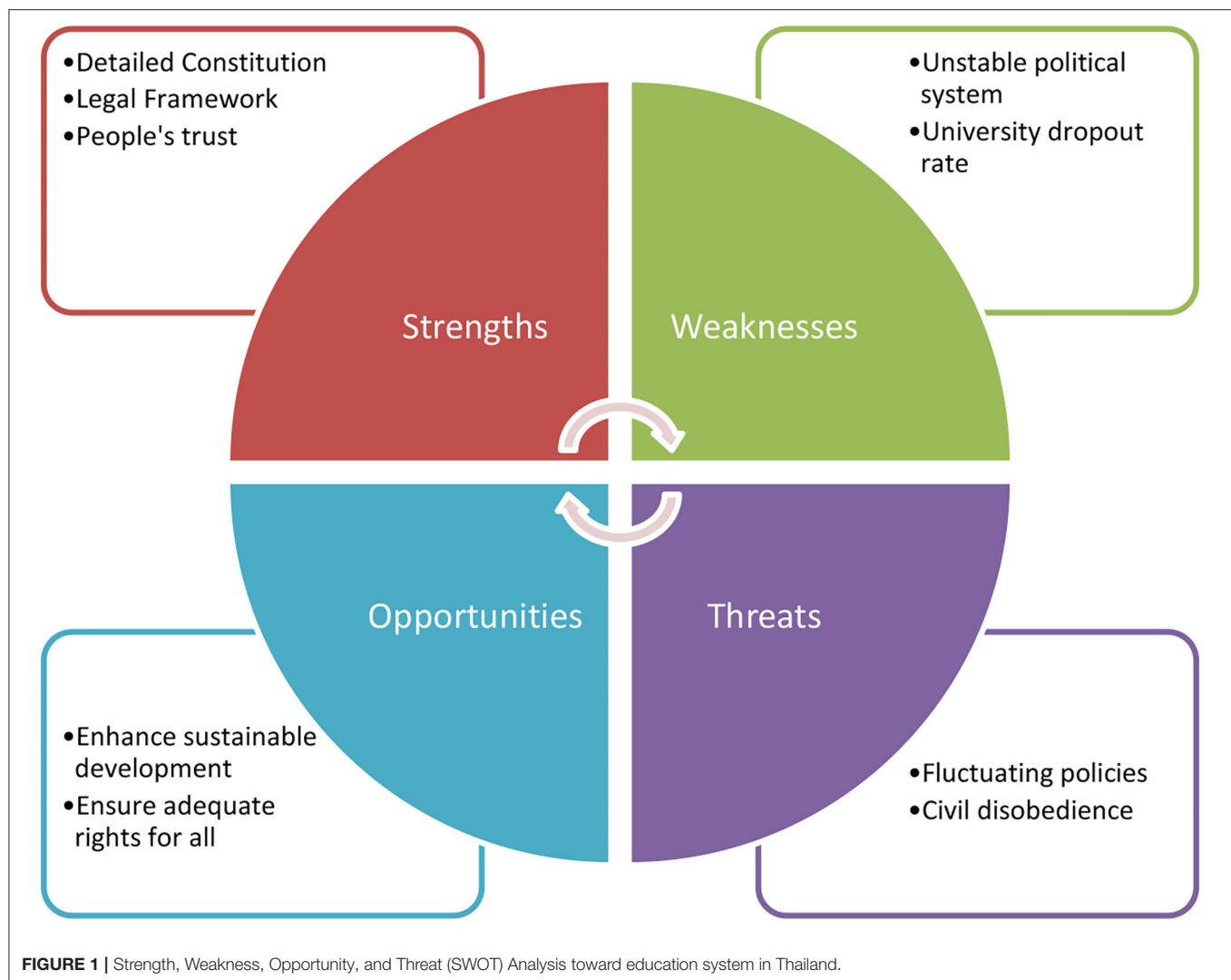
of copyright and human rights. The judiciary is comprehended toward the maintenance of law and order in Thailand. The people of Thailand abide by the legal system. One of the respondents added,

"Thai nationals follow all the rules and regulations including wearing face masks and vaccinations. The government should investigate supporting our children. It is hard for us to provide for the online class system."

Therefore, they do deserve all the adequate laws to minimize their vulnerabilities, especially during the COVID-19 pandemic. The amendments and reforms should be adopted through the existing and implemented exemplary laws from ASEAN to ensure the success of the legal framework (Phusavat, 2008).

Weaknesses

Thailand has one of its biggest flaws in the legal framework in the form of its unstable political system. The unclear authority of the monarchy along with the democratic government and several incidents of military coups in the past resulted

in reduced rights of the people. Though the government promotes various educational policies, however, they fall short of providing the economic, social, and legal protection of its population. The ground-level implementation of the laws is dependent upon the military forces. One of the respondents added,

"The university in our area do not follow the government initiatives. We still need to pay the full tuition fees which is supposed to be reduced in all the universities."

The influence of stakeholders to resolve the issues relating to pandemic teaching barriers is contradictory to the educational outlook toward education (Mongkolhutthi, 2018). Thailand suffers from the absence of procedural guidelines for the educational system during the COVID-19 pandemic. One of the respondents suggested,

"We do not know when to have hybrid classroom. We are worried about the health and safety of the students. Should we test students or it's the personal responsibility of the students? Who will pay for the vaccination and medical aid?"

This hampers the guided learning practices in the educational policy level implications (Naqvi and Sahu, 2020). University dropout rates have been a constant threat to the sustainable development of the education system in Thailand. Therefore, it becomes essential to understand the perceptions of the students as well (Sittichai, 2012; Lerdpornkulrat et al., 2016).

Opportunities

Despite several shortcomings, the reforms in the copyright and human rights laws would ensure long-term growth and enhance sustainable development. The COVID-19 pandemic does provide for better understanding and analyzing the gaps in the education system and provides recommendations (Nuankaew et al., 2021). One of the respondents recommended,

"Hybrid classroom makes more sense. Those who want to have face to face onsite class may choose that, others may study online. The teachers are to be trained to conduct and support these hybrid classrooms effectively."

The education system will change in the future; therefore, hybrid education is going to be the most adopted method including both physical and virtual classrooms (Azorín, 2020). The amendment in the constitution ensures the laying down of adequate policies. Ensuring adequate rights for all is a must for maintaining the law and order in any country. Thailand is a state which leads not only its economy but also influences the growth and development of the whole ASEAN region. The international collaborations and learning of apt means of implementation of rules and regulations are to be adopted at the national as well as local levels of governance. The state among ASEAN provides an example for Thailand on how, where, when, and who must be utilized to ensure effective law infrastructure.

Threats: The fluctuating policies are the main instigating factor that affects the harmony among the Thai population. One of the respondents proposed,

"Reforms are required at the national level. Ground level implications will be adversely affected if no guidelines are provided."

The inadequacies found with loopholes in the constitution of Thailand must be revised and adequately reformed. The exemplary evidence and cases from ASEAN and other countries must be carefully examined to be adopted in Thailand (Abidah et al., 2020; Yang et al., 2020; Adarkwah, 2021; Tabatadze and Chachkhiani, 2021). Another aspect is the increasing civil disobedience in Thailand. This is found to be directly proportional to the subdued rights provided to the free people of Thailand. One of the respondents indicated,

"Who will judge the measures of the government? Students suffering in several ways. What about their future? Protests are conducted peacefully. We want the basic rights. Is it too much to ask for education?"

The various wings of the political mindset are a constant hurdle in providing adequate implementation of rules and regulations in Thailand (Buchenrieder, 2017).

The SWOT analysis provides an in-depth analysis of the current shortcomings of the Thai education system. However, due to the existence of an adequate physical framework of education, the policy implementations at the ground level would

ensure the sustainable development of the Thai education system (Phusavat et al., 2012).

DISCUSSION

Education shapes the future of any country by empowering its youth and future workforce (Kremer, 1993; Deem et al., 2008; Hardaker, 2022). Online education has been adopted in several countries around the globe in the wake of the COVID-19 pandemic. The educational shift to the online classrooms inclusive of Massive Open Online Course (MOOC) is seen as a rapid transition and ineffective due to the lack of experience of teachers, students, and parents (Burns, 2020). The parents and students are under the constant pressure of diminishing return value both financially and quality of education. The monetization of education in terms of online education has been a concern in the education literature (Giroux, 2002). The educational reforms are to be adopted and implemented at the local levels of the government to ensure quality and uninterruptible educational rights. The pedagogy for online or hybrid education must involve the consideration, resources, policies, and adequate implementations from the government and other stakeholders (Head, 2020). Therefore, it is essential to revisit and amend the constitutional and legal framework in order to provide a compassionate quality of education to all students.

The sustainable development of Thailand during the pandemic era depends upon the robustness of its education and business sectors. The skill development at the higher education level is necessary along with the new technologies and digital advancements. The Thai education system is prevalent at all levels of governance, however, the students, being the major stakeholders are avoided in the policy formulation and implementation (Srichaiyarat and Lao-Amata, 2020).

The Thai constitution provides for the rights and overall development of the Thai population. However, during the pandemic scenario, several important factors were neglected among the youth and the education system. Education is regarded as an important sector to be controlled and regulated by the government as a public service (Anussornnitisarn et al., 2010). Thailand stands at 59th rank out of 137 countries under the global competitiveness index by the world economic forum. This rank is declining further in the wake of the COVID-19 pandemic since 2020. Thus, the result of this study provides for the revisions required to be amended at the constitutional level. The educational reforms were found to be required in terms of both qualitative and quantitative factors with a focus on the digital advancement ensuring the reach of technologies to attain interrupted education along with the inclusion of stakeholders at the ground level policy implementation.

This research provides for an in-depth analysis of the factors and stakeholders governing the educational reforms in Thailand. Previous studies have been rigorously exploring the adequacy of the online education system (Pierna et al., 2009; Yukongdi, 2010; Kainzbauer and Hunt, 2014; Balakrishnan, 2020; Mindzak, 2020; Velle et al., 2020; Tabatadze and Chachkhiani, 2021; Bataineh et al., 2022), however, the gaps remain with the actual need of

the student and role of the governance mechanisms to provide quality education and equity of educational rights for all. The need for social, economic, and educational reforms is paramount to ensure the rights of all to receive quality education during and after the COVID-19 pandemic.

CONCLUSION

The demographic characteristics of Thai students have an impact on their learning, perceptions, and experiences while educating themselves at various levels of university life. Age and gender are major factors in reluctance to absorb the new education system. The constant shift and changes toward the onsite, online, or hybrid classroom are one of the factors which diminish the enthusiasm of Thai students toward education. The digital technologies and legal framework are existing at the national level; however, inadequate and obsolete policies are resulting in enhancing the vulnerabilities and barriers to the education system in Thailand. Therefore, constitutional amendments and adequate implementation of the education policies are a must at the ground level in the Thai education system.

Recommendations

Thailand has been revisiting the laws, acts, policies, and ordinances to provide rights to its citizen. However, the study sheds light on the loopholes existing in the legal framework in Thailand. The following are the recommendations for the local and national level legal framework in Thailand.

- The government should amend the sections related to primary, secondary, and higher education in the constitution and policies.
- The local level of governance should be strengthened to implement the laws of the land.
- The awareness campaigns and training of stakeholders such as students, teachers, and parents to enhance the educational teaching and learning in Thailand.
- Creation of public-private partnership at the local level for adequate policy implications.
- Implementation of digital technologies at universities in collaboration with local government.

The study paves way for further research into the innovative technologies and student rights to empower the education system in Thailand. Further research may be undertaken for employment opportunities after graduation in times of the COVID-19 pandemic.

DATA AVAILABILITY STATEMENT

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding authors.

AUTHOR CONTRIBUTIONS

Both authors listed have made a substantial, direct, and intellectual contribution to the work and approved it for publication.

ACKNOWLEDGMENTS

REFERENCES

Abidah, A., Hidaayatullaah, H. N., Simamora, R. M., Fehabutar, D., Mutakinati, L. (2020). The impact of covid-19 to indonesian education and its relation to the philosophy of "Merdeka Belajar". *Stud. Philos. Sci. Educ.* 1, 38–49. doi: 10.46627/sipose.v1i1.9

Adarkwah, M. A. (2021). "I'm not against online teaching, but what about us?": ICT in Ghana post Covid-19. *Educ. Inf. Technol.* 26, 1665–1685. doi: 10.1007/s10639-020-10331-z

Ali, W. (2020). Online and remote learning in higher education institutes: a necessity in light of COVID-19 pandemic. *High. Educ. Stud.* 10, 16–25. doi: 10.5539/hes.v10n3p16

Anussornnitisarn, P., Rassameethes, B., Fankham-ai, K., Forss, T., Helo, P. (2010). Innovation in the public sector: the roles of external influences. *Int. J. Innov. Learn.* 7, 467–477. doi: 10.1504/IJIL.2010.032934

Azorín, C. (2020). Beyond COVID-19 supernova. Is another education coming?. *J. Prof. Cap. Community* 5, 381–390. doi: 10.1108/JPCC-05-2020-0019

Balakrishnan, P. (2020). Education in the age of COVID-19: educational responses from four Southeast Asian countries. *ISEA* 48, 102–109.

Bataineh, O., Abu-Fares, M., and Al-Jdayeh, M. (2022). On the factors that affect concentration variations in a veterinary drug using backward stepwise regression analysis. *s.l., AIP Publishing LLC* 020007. doi: 10.1063/5.0075137

Buchenrieder, G. (2017). Participatory local governance and cultural practices in Thailand. *Cogent Soc. Sci.* 3:1338331. doi: 10.1080/23311886.2017.1338331

Burns, R. (2020). A COVID-19 panacea in digital technologies? Challenges for democracy and higher education. *Dialogues Hum. Geogr.* 10, 246–249. doi: 10.1177/2043820620930832

Cohen, L., Manion, L., and Morrison, K. (2017). "Coding and content analysis," in *Research Methods in Education, 8th Edn*, eds L. Cohen, L. Mnion, and K. Morrison (London: Routledge), 440–456. doi: 10.4324/9781315456539

Connors, M. K. (1999). Political reform and the state in Thailand. *J. Contemp. Asia* 29, 202–226. doi: 10.1080/00472339980000321

Constitution B.E. 2560 (2017). *Constitution of the Kingdom of Thailand.* Available online at: https://www.constitutionalcourt.or.th/occ_en/download/article_20170410173022.pdf

Deem, R., Mok, K., and Lucas, L. (2008). Transforming higher education in whose image? Exploring the concept of the 'world-class' university in Europe and Asia. *High. Educ. Policy* 21, 83–97. doi: 10.1057/palgrave.hep.8300179

Dwivedi, Y. K., Hughes, D. L., Coombs, C., Constantiou, I., Duan, Y., Edwards, J. S., et al. (2020). Impact of COVID-19 pandemic on information management research and practice: transforming education, work and life. *Int. J. Inf. Manage.* 55:102211. doi: 10.1016/j.ijinfomgt.2020.102211

Ferri, F., Grifoni, P., and Guzzo, T. (2020). Online learning and emergency remote teaching: opportunities and challenges in emergency situations. *Societies* 10:86. doi: 10.3390/soc10040086

Fry, G. W., and Bi, H. (2013). The evolution of educational reform in Thailand: the Thai educational paradox. *J. Educ. Adm.* 51, 290–319. doi: 10.1108/09578231311311483

Giroux, H. (2002). Neoliberalism, corporate culture, and the promise of higher education: the university as a democratic public sphere. *Harv. Educ. Rev.* 72, 425–464. doi: 10.17763/haer.72.4.0515nr62324n71p1

Hardaker, S. (2022). *More Than Infrastructure Providers–Digital Platforms' Role and Power in Retail Digitalisation in Germany.* Tijdschrift voor economische en sociale geografie, p. 1–19. doi: 10.1111/tesg.12511

Head, K. (2020). *Let's add compassion to our online curriculum. The Chronicle of Higher Education, 31 March.* Available online at: https://www.chronicle.com/article/Let-s-Add-Compassion-to-Our/248391 (accessed: March 31, 2022).

Helms, M., and Nixon, J. (2010). Exploring SWOT analysis – where are we now? A review of academic research from the last decade. *J. Strategy Manage.* 3, 215–251. doi: 10.1108/17554251011064837

Huang, R., Tlili, A., Chang, T. W., Zhang, X., Nascimbeni, F., and Burgos, D. (2020). Disrupted classes, undisrupted learning during COVID-19 outbreak in China: application of open educational practices and resources. *Smart Learn. Environ.* 7:19. doi: 10.1186/s40561-020-00125-8

Hussain, M. W., Mirza, T., and Hassan, M. M. (2020). Impact of COVID-19 pandemic on the human behavior. *Int. J. Educ. Manage. Eng.* 10, 35–61. doi: 10.5815/ijeme.2020.05.05

Kainzbauer, A., and Hunt, B. (2014). Meeting the challenges of teaching in a different cultural environment – evidence from graduate management schools in Thailand. *Asia Pac. J. Educ.* 36, 56–68. doi: 10.1080/02188791.2014.934779

Kantavong, P., and Nethanomsak, T. (2012). Inclusive education in Thailand after 1999 National Education Act: a review of a pre-service teacher education system. *Proc. Soc. Behav. Sci.* 69, 1043–1051. doi: 10.1016/j.sbspro.2012.12.031

Kew, S. (2018). Examining the motivation level of students in e-learning in higher education institution in Thailand: a case study. *Educ. Inf. Technol.* 23, 2947–2967. doi: 10.1007/s10639-018-9753-z

Kremer, M. (1993). The O-ring theory of economic development. *Q. J. Econ.* 108, 551–575. doi: 10.2307/2118400

Kunnamas, N. (2020). Normative power Europe, ASEAN and Thailand. *Int. Econ. Econ. Policy* 17, 765–781. doi: 10.1007/s10368-020-00478-y

Laikram, S., and Pathak, S. (2022). Essentialities of ratifying CED in Thailand: human rights amid Covid-19 pandemic. *Emerg. Sci. J.* 6, 57–70. doi: 10.28991/esj-2022-SPER-05

Learned, E., Christiansen, C., Andrews, K., and Guth, W. (1969). *Business Policy: Text and Cases.* Irwin: Homewood, IL.

Lerdpornkulrat, T., Koul, R., and Poondej, C. (2016). Relationship between perceptions of classroom climate and institutional goal structures and student motivation, engagement and intention to persist in college. *J. Further High. Educ.* 42, 102–115. doi: 10.1080/0309877X.2016.1206855

Mindzak, M. (2020). COVID19 and the ongoing problem of educational efficiency. *Brock Educ. J.* 29, 18–23. doi: 10.26522/brocked.v29i2.837

Mongkolhutthi, P. (2018). Understanding what binds teachers together: workplace culture amongst EFL teachers in Thailand. *Educ. Forum* 82, 406–424. doi: 10.1080/00131725.2018.1473541

Mujtaba, B., Chawavisit, C., and Pattaratalwanich, P. (2010). Conflict management styles of law students in Thailand: a study of age and gender. *J. Glob. Bus. Manage.* 1, 14–32.

Naqvi, W. M., and Sahu, A. (2020). Paradigmatic shift in the education system in a time of COVID 19. *J. Evol. Med. Dent. Sci.* 9, 1974–1976. doi: 10.14260/jemds/2020/430

Nuankaew, P., Nuankaew, W., Nasa-Ngium, P., Phanniphong, K., Teeraputon, D., and Chaopanich, O. (2021). Attitude towards online learning from the effect of Coronavirus 2019 disease (COVID-19) of University Students in Thailand. *PalArch's J. Archaeol. Egyptol.* 18, 2498–2517. Available online at: https://archives.palarch.nl/index.php/jae/article/view/6680

Phusavat, K. (2008). University reforms: roles of classification in resource allocation and management. *Int. J. Manage. Educ.* 2, 318–339. doi: 10.1504/IJMIE.2008.019638

Phusavat, K., Ketsarapong, S., Ooi, K., and Shyu, S. (2012). Sustaining higher education reforms: knowledge and policy implications learned from Thailand. *Int. J. Educ. Manage.* 26, 284–301. doi: 10.1108/09513541211213354

Pierna, J. A. F., Abbas, O., Baeten, V., and Dardenne, P. (2009). A Backward Variable Selection method for PLS regression (BVSPLS). *Anal. Chim. Acta* 642, 89–93. doi: 10.1016/j.aca.2008.12.002

Sanjaiprom, S. (2021). Learning online preparedness during the COVID-19 pandemic in Thailand. *J. MCU Peace Stud.* 9, 884–894. Available online at: https://so03.tci-thaijo.org/index.php/journal-peace/article/view/250814/169036

Sittichai, R. (2012). Why are there dropouts among university students? Experiences in a Thai University. *Int. J. Educ. Dev.* 32, 283–289. doi: 10.1016/j.ijedudev.2011.04.010

Srichaiyarat, P., and Lao-Amata, P. (2020). Legal education during covid-19 pandemic: an experience of a thai law school. *Asian J. Legal Educ.* 7, 228–230. doi: 10.1177/2322005820035753

Tabatadze, S., and Chachkhiani, K. (2021). COVID-19 and emergency remote teaching in the country of Georgia: catalyst for educational change and reforms in Georgia?. *Educ. Stud.* 57, 78–95. doi: 10.1080/00131946.2020.1863806

Teo, T. (2014). Exploring e-learning acceptance among university students in Thailand: a national survey. *J. Educ. Comput. Res.* 50, 489–506. doi: 10.2190/EC.50.4.c

Tongpoon-Patanasorn, A. (2011). Impact of learner-centeredness on primary school teachers: a case study in Northeast Thailand. *J. Asia TEFL* 8, 1–28.

Velle, L., Newman, S., Montgomery, C., and Hyatt, D. (2020). Initial teacher education in England and the Covid-19 pandemic: challenges and opportunities. *J. Educ. Teach.* 46, 596–608. doi: 10.1080/02607476.2020.1803051

Wintachai, J., Khong, T. D. H., and Saito, E. (2021). COVID-19 as a game changer in a Thai university: a self-reflection. *Practice* 3, 51–57. doi: 10.1080/25783858.2020.1833233

Woodrow, L. (2014). *Writing About Quantitative Research in Applied Linguistics.* London: Springer. doi: 10.1057/9780230369955

Yang, D. -Y, Cheng, S. -Y., Wang, S. -Z., Wang, J. -S., Kuang, M., Wang, T. -K., et al. (2020). Preparedness of medical education in China: lessons from the COVID-19 outbreak. *Med. Teach.* 42, 787–790. doi: 10.1080/0142159X.2020.1770713

Yu, T., and Jo, I. H. (2014). "Educational technology approach toward learning analytics: relationship between student online behavior and learning performance in higher education," in *Indianap. Assoc. Comput. Machinery* (Indianapolis, IN). 269–270.

Yukongdi, V. (2010). A study of Thai employees' preferred leadership style. *Asia Pac. Bus. Rev* 16, 161–181. doi: 10.1080/13602380903168962

Factors Contributing to English as a Foreign Language Learners' Academic Burnout: An Investigation Through the Lens of Cultural Historical Activity Theory

Quyen Thi Thuc Bui[1], Thanh Do Cong Bui[1] and Quang Nhat Nguyen[2]*

[1] Faculty of Foreign Languages, Ho Chi Minh City Open University, Ho Chi Minh City, Vietnam, [2] HQT Education Co. Ltd., Ho Chi Minh City, Vietnam

During the shift from face-to-face to online emergency classes due to the COVID-19 pandemic, learners of English as a Foreign Language (EFL) were under constant pressure to familiarize themselves with the once-in-many-generations learning context. Based on the cultural-historical activity theory (CHAT), this qualitative study investigated factors contributing to EFL learners' academic burnout at Open University, Vietnam. The interviewees were seven students, two teachers, and two administrators recruited using a theoretical-based sampling technique. The data consisted of iterative rounds of interviews which lasted approximately 60 min each until the data saturation point was reached. The content analysis revealed six factors that impacted EFL learners' physical and psychological exhaustion, including prolonged online learning time, privacy concerns and cyber-bullying, teachers' role, institution's role, and support community outside the classroom. Also, teachers' insufficient preparation for online teaching and students' academic misconduct during exams were factors that created EFL learners' academic cynicism. Finally, participation in social networking sites' extracurricular activities, participation checking, and cheating in exams affected the last dimension of academic burnout, the sense of academic achievement. Based on this study, the authority, administrators, and teachers can take a more proactive role in supporting students in curbing their academic burnout during this unprecedented pandemic. The authors also hope that this study can lay the foundation for further humanistic research into the EFL learner's psychological world in online classes, particularly when each student's social and cultural background is considered.

Keywords: academic burnout, cynicism, emergency language teaching, exhaustion, sense of academic achievement

INTRODUCTION

Since the outbreak of the COVID-19 pandemic, countries in Africa, Asia, Europe, the Middle East, North America, and South America have announced or implemented school closures, influencing over 90% of the student population in the world (UNESCO, 2020). In response to this pandemic, many schools and institutions have decided to switch to online teaching and learning to continue

their operations. While online learning is by no means new in the digital age and has been opted for by an increasing number of learners, emergency online learning is only an immediate solution for unexpected situations that schools and institutions resort to maintain their operation and the students learning. As a result of the sudden transition, both teachers and students have to try to familiarize themselves with the new learning environment. So far, although research has been conducted on what teachers have done to cope with the challenges of COVID-19 (MacIntyre et al., 2020) and their burnout (Bottiani et al., 2019; Sokal L. et al., 2020), a minimal body of research focus on the burnout syndrome experienced the students, particularly English as a Foreign Language (EFL) learners. Because stress and academic burnout can adversely affect students' academic performance (May et al., 2015), it is crucial to investigate what factors affect learners' academic burnout in emergency EFL classrooms amidst the COVID-19 pandemic. The authors seek to investigate what factors affect EFL learners' academic burnout from an ecological perspective within this qualitative study.

The first part of this article aims to contextualize and specify this research's theoretical and practical contribution to the current EFL education in this once-in-many-generations pandemic. The following part reviews fundamental concepts related to academic burnout, factors contributing to academic burnout investigated by other previous studies, cultural-historical activity theory (CHAT), and the CHAT model. Next, the article elaborates on research methodology, data analysis, and research findings before discussing how the research findings support or reject other studies, dominantly quantitative, about academic findings among EFL learners. Within the discussion, the authors also discuss what the authority, administrators, and teachers can do to help curb academic burnout among university EFL students. Finally, the research concludes with a summary of the main points, admits research limitations, and proposes a research direction for further investigation into how to help learners overcome their burnout state.

LITERATURE REVIEW

Burnout

Burnout is originally related to a psychological syndrome associated with workplace settings (Maslach et al., 2001). Besides burnout among professionals, students' academic burnout has been found in education. Many college students experience the syndrome to a certain degree during their learning process (Balogun et al., 1996; Jacobs and Dodd, 2003). The *Maslach Burnout Inventory* adopts a three-dimensional model predicting the perceivable symptoms among college students (Schaufeli et al., 2009; Portoghese et al., 2018), which includes *exhaustion, cynicism,* and *professional efficacy*. Exhaustion is severe fatigue that students experience regardless of the causes (Salanova et al., 2005). Cynicism is students' indifference toward their academic work. Finally, professional efficacy demonstrates students' satisfaction toward their accomplishment and their expectations of future development at schools. However, as this study only focuses on EFL rather than subjects related to

students' future profession, the authors would use the term *sense of academic achievement* instead of *professional efficacy*.

Factors Contributing to Academic Burnout in Online Emergency English as a Foreign Language Class

Whether e-learning, particularly in emergency classrooms, leads to more burnout among students is still open to question and controversy. In the cross-sectional survey-based research with 619 medical students in the first phase and 798 students in the second phase, Bolatov et al. (2021) reported that students' mental health improved when transferring from traditionally learning to online learning. However, Bolatov et al.'s (2021) study did not deny the negative changes in learning performance due to depression, anxiety, and dissatisfaction. Indeed, many opposing studies claim that students succumb to new factors of burnout during the pandemic. Mental health stressors such as quarantine time, isolation, and the lack of face-to-face interaction are linked to emotional depression and burnout in the classroom. Additionally, physical issues related to extended exposure to the computer screen, namely eye strain, neck pain, headache, and back pain, are also sources of students' fatigue and burnout (Mheidly et al., 2020). Researchers even started using the term *Zoom fatigue* to signify that the abrupt deviation from traditional and fine-tuned face-to-face communication creates physical and mental tensions for learners (Fauville et al., 2021; Peper et al., 2021; Samara and Monzon, 2021). Fauville et al.'s (2021) survey concluded that the respondents were socially, emotionally, visually, and motivationally fatigued due to the inappropriate frequency, duration, and business during Zoom meetings or synchronous digital meetings in general. There are also studies claiming that because teachers and students are not always competent technology users, inadequate digital affordances and technical support should be provided for online learning (Misirli and Ergulec, 2021), otherwise, they will have problems accessing the learning platforms due to Internet connection issues (Khlaif et al., 2021). Also, students' problems with etiquette and behaviors in online learning settings require attention (Conrad, 2002; Kao, 2020). Although digital issues create academic inhibition, insecurity, and uncertainty among learners (Arroyo et al., 2015; van Rensburg, 2018; Kao, 2020), limited research has been conducted to link these problems with students' academic burnout, nor have learners been given sufficient opportunities to have their issues listened in official studies.

Undeniably, previous research has contributed to the knowledge of some fundamental causes and repercussions of burnout, but these research articles still have several inherent limitations related to research perspective and methodology. First, studies usually investigate learners in general terms and disconnect them from their social-cultural background. Studies related to human psychology should not separate the participants from their living conditions; otherwise, we can only understand their problem at face value. Some valuable information related to burnout sometimes cannot be obtained through statistics. For example, it is likely that supportive and digitally knowledgeable parents help reduce academic burnout compared to their less
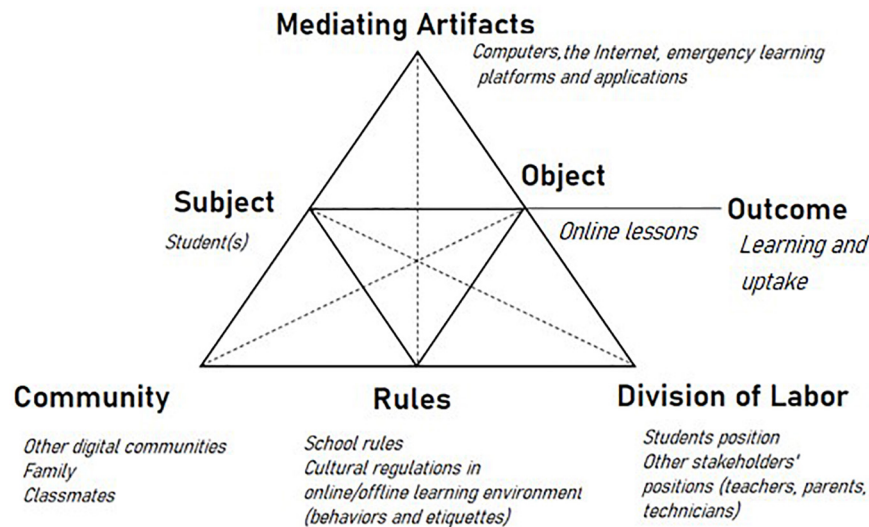
FIGURE 1 | Model of students' activities in the online emergency classroom [adapted from Engeström (1987)].

supportive counterparts, but how students grade how supportive their parents are on a Likert scale is questionable. Second, other studies have not addressed the role of educators in supporting or exacerbating students' mental health. Pedagogical approaches, classroom contents, time allocation for teacher talking time, student talking/working time, and the like cannot be overlooked. Third, some research projects only look at students as passive recipients, without agency, proactive adaptation, and adjustment, when they use phrases like "coping" or "academic coping" (Noh et al., 2016; Kim, Kim and Lee, 2017; Mheidly et al., 2020), with which we disagree from an ecological and humanistic perspective.

Regarding the three limitations mentioned, the authors propose that academic burnout should look at students in an ecology that connects them to their academic and non-academic communities, learning tools, and regulations. Each student's social context should be carefully considered, and students should be active participants who also have the decisive power in their own learning process, no matter whether they engage consciously in burnout prevention or not. What and why students develop their burnout syndrome should be investigated in a social, cultural, physiological, and pedagogical spider web rather than as discrete dimensions. These are justifications to call for the application of the CHAT in academic burnout studies.

The Cultural Historical Activity Theory

Human activities should not be investigated from the sociocultural perspective as a simple relationship between actors and objects because humans are dependent on society (Stetsenko and Arievitch, 2004). According to the sociocultural theory of cognitive development, human activity is mediated by historical and social artifacts such as signs, tools, and instruments. Leontiev (1978) further added that an objectless activity is devoid of any meaning, which in turn contributes to formulating the CHAT, also known as Activity Theory (AT), as an object-related theory (Engeström and Sannino, 2010). The goal of CHAT is to explore

the constantly changing and increasingly complicated exchange that constitutes the existence of all organisms (Stetsenko and Arievitch, 2004). Acknowledging the interim between human activities and society to avoid reductionist ontology, this article adopts the CHAT framework by Engeström (1987), which allows insights into how societal components can mediate teaching and learning through both tangible and intangible factors. Within this framework, Engeström (1987) suggested six components contributing to human activity: subject, object, mediating artifacts, community, rules, divisions of labor, and outcome (see **Figure 1**).

A *subject* is an individual or group of people whose burnout state is the focus of this analysis. On the other hand, in an online emergency classroom, the objects are online lessons conducted synchronously and asynchronously to facilitate the learning and uptake of knowledge. The student's learning activity is enabled and mediated by *external artifacts* and *internal tools*. The devices and tools applied in an online emergency classroom are computers, the Internet, learning platforms (both synchronous and asynchronous), and learning applications, which, in semiotic cooperation budget, the learner can acquire their knowledge. Besides, *rules* regulate the learning process as learners interact with their academic communities, families, and other non-academic digital and real-life social networks. Initially, the *community* shares the same object with the students, such as instructors and classmates. However, communities also extend to the cultures and experiences with others throughout learners' developmental processes. When interacting with the students' learning activities, different stakeholders, such as teachers or administrators, also share the division of power and status called the *division of labor*. The understanding of the division of labor necessitates the investigation of social roles and identities. In a classroom, the division of labor can also be considered the division of symbolic labor, where the identities of different stakeholders are embedded in different discourses (Thorne, 2000).

It is worth notetaking that there are reciprocal impacts among the constituents of the whole activity model. In the middle of perennial shutdowns and lockouts, learners, staying with their family, are tied to a significantly wide diversity of learning contexts, responsibilities, communications, and interactions. This large and unpredictable social-cultural spectrum makes any attempts to generalize learners ineffective and futile. With a humanistic and ecological viewpoint, we hoped to investigate each learner as a unique individual that was subject to different adversities, listen to their stories of how they were struggling every day, and share with the readers their constant efforts to sustain their education despite their limited resources during the COVID-19 pandemic. Based on this framework, this article aims to investigate:

> What factors influenced the EFL learners' academic burnout while learning online during the COVID-19 pandemic?

To fully answer this question, the research group will examine three sub-questions about factors influencing different dimensions of academic burnout, as follows:

> What factors influenced EFL learners' exhaustions while learning online during the COVID-19 pandemic?
> What factors influenced EFL learners' academic cynicism while learning online during the COVID-19 pandemic?
> What factors influenced EFL learners' sense of academic achievement while learning online during the COVID-19 pandemic?

METHODS AND RESEARCH DESIGNS

Research Design

This study employed the qualitative research method from the pragmatic ontology and ecological epistemology. The pragmatic ontology prioritizes mixed exploratory methods that the researchers deem the most effective rather than relying solely and rigidly on a method or a philosophy that tries to capture absolute truth (Frey, 2018). In terms of epistemology, the authors hold an ecological worldview that focuses on a situated and contextualized ecocentric understanding of knowledge to minimize context, data, and complexity reduction of complicated and sophisticated social activities (van Lier, 2004).

The authors believed it was optimal to utilize the qualitative research design of this study with a multiple case study approach within the cultural historical activity framework. The multiple case study allowed researchers to comprehend better and theorize the prominent phenomenon (Brantlinger et al., 2005). Also, the multiple case study with the cultural historical activity theoretical framework focused on the non-idiosyncratic voices of different participants suffering from the COVID-19 pandemic.

Sampling Techniques and Participant Recruitment

The researchers chose to apply theoretical-based sampling because this sampling technique involves selecting essential manifestations of the phenomenon of interest or the real-world cases of the research constructs (Suri, 2011). In the first round of participant recruitment, the researchers chose students of different social backgrounds so that the participants with different social backgrounds could voice their issues. As learning should be humanistic and differentiated, different learners with different backgrounds may have different reasons for their burnout state. Thus, it is of paramount importance for humanistic researchers to unbiasedly empower those of different social statuses and backgrounds rather than biasedly prioritizing or generalizing the learners' contexts. The interviews were conducted in the participants' mother tongue which is also the native language of the researchers who are Vietnamese teachers of English. However, as the finalized manuscript was written in English, two authors and a professional translator independently translated the transcript to avoid back-translation's drawbacks (Behr, 2017). The translated transcript then was compared and the translation group would discuss with each other to address any discrepancies. The translation was finally reviewed by the corresponding and lead author to make sure that misinterpretation is minimal. After the first recruitment round, constant comparisons were made between the students' responses as the researchers continued to hypothesize the stakeholders representing each chain of the CHAT framework and identified significant theoretical constructs that emerged. In the second recruitment round, the researchers could choose more participants such as teachers and technical administrators to represent the new theoretical constructs and provide more multilateral information about the students' burnout state. The language of communication was the local language shared by the participants and the researchers. To reach data saturation and sufficiency, at which point all additional data emerged had been explored and exhausted, the researchers prioritized the sample adequacy over sample size (Bowen, 2008).

A Description of the Participants

In the first interview round, student A was a female sophomore from another province. As a former COVID-19 patient, she spent about 40 days in hospital in Ho Chi Minh City (HCM City, hereafter). She had difficulty studying in bed in the slow Wi-Fi that she shared with many other patients during the treatment. Upon being released from the hospital, she returned to her rented place in HCM City. She studied in the room, which was also the workplace of her uncle.

Student B was a male sophomore who was well-supported by his family. He had a private room, a high-speed Internet connection, and his own laptop. He reported that he felt comfortable but not as disciplined as in school while learning offline at home. Sometimes, he was interrupted by some emergent chores while his family was not around.

Student C was a female freshman student. At the time of the interview, as regulated by the government, she stayed in a quarantine zone in her hometown after leaving HCM City. Since she did not bring her laptop with her, she had to study with her mobile phone the whole time. Student C had to suffer such inconveniences as low Wi-Fi signal, no necessary furniture, or no private space while in quarantine.

Student D was a male freshman who has just returned from the hospital after 3 weeks of COVID-19 treatment. As a student from another province, he shared one room with another friend while in HCM City. The student did not have financial difficulty or health problems.

Student E was a female freshman. She insisted that it was the students' responsibility to make an effort in their studies. When the pandemic started the second time, she returned home to the mountainous region. She had her laptop and a study room with a Wi-Fi signal. The Internet connection in her hometown was not always stable, and sometimes her laptop did not work properly.

Student F, a female freshman from a province far from school, studied with mobile phones and laptops. For the first few weeks of the semester, she stayed in HCM City, sharing a room with another friend. Her first problem was that she could not sign into the MS Team. Student F had reported the problem to the school, but it could not be fixed. Therefore, she could not attend the classes. She had no choice but to review the lessons, use the recorded videos and slides the lecturer posted on the Learning Management System (LMS) after each session, and submit the given assignments to the system.

Student G, a female sophomore, lived with her family in HCM City. She had to study in the living room where she sometimes was inevitably unintentionally distracted by the family members or her pet. She said her language teacher had created a Zalo group to increase interaction with her class members, check and remind students to work.

In the second interview round, the authors invited two teachers A and B, who were teaching in the EFL courses and two administrators who were running the emergency online EFL program. However, upon the participants' request, detailed descriptions of the teachers and the administrators are kept confidential.

Interview

The first set of interview questions for the students included 15 questions revolved around the ideas about how other parts of the CHAT framework, for example, the school regulation or the teachers, affected their burnout state. The first five questions inquired about the students' background, while question four investigated students' academic anxiety resulting from the COVID-19 pandemic. From questions five to seven, the students were asked about their experience with their university, including technical, administrative, and psychological aspects, and the following five questions asked students to talk about their teachers and friends. The last three questions investigated how family and personal factors might affect their burnout. The second question set for teachers and school administrators consisted of six questions about their observation regarding students' burnout and psychological factors, school support, and students' supervision. As King and Horrocks (2010) suggest, the interviews started with fundamental and less complicated research questions before progressing to more advanced research questions. Additionally, several questions included a probe and prompt feature to assess interviewees' understanding and prompt the interviewees to clarify themselves

(Jacob and Furgerson, 2015). As the interview was semi-structured, the author conducted progressive refinement of questions after synthesizing and analyzing each interview recorded to accelerate the data saturation and sufficiency (Suri, 2011).

Procedures

After getting the university's consent, the researchers sent out the participant recruitment document and asked for references from the university lecturers about who could be the potential participants for the study. After identifying the participants, the researchers informed them about the research aims, purposes, procedures, benefits, and risks, and asked for their consent to participate anonymously in the research. The interviewers set up one-hour interviews using online conference software (Zoom and Google Meets) when the participants agreed to join due to the COVID-19 pandemic. Before the interview, the interviewers had discussed the meaning of *burnout and academic* with participants to reach a mutual understanding of the term used in the interview. Each interview was recorded, transcribed, and closely examined. The data collection and data analysis were iterative, as the data analysis with students oriented how to choose more interviewees and how questions should be refined and adjusted for the following interview. The authors discussed and finalized the main themes in several meetings to ensure no critical theme was left out and sent them to the participant for their reconfirmation. This stage was repeated until all the participants agreed that no critical idea was missing from the research.

DATA ANALYSIS

The researchers used content analysis techniques with word frequencies and auto-coding tools provided by Nvivo 24. The submerging constructs gathered from the students' interviews were then used to identify more potential stakeholders such as the teachers and administrators. The data collected from the teachers and the management about their perceptions of how burnout the students were then analyzed to find more emerging themes and triangulate the students' answers. The code analysis was a combination of inductive and deductive coding based on the overarching areas of investigation in the CHAT model.

FINDINGS

Based on the CHAT framework, the interviews revealed four main areas that directly affected EFL students' academic burnout, including only 4 areas (see **Appendix Table 1**).

Mediating Artifacts
Technical Facility and Internet Connection
The first factor of mediating artifacts is technology facilities such as Internet connections, computers, laptops, and smartphones. While students who lived at home or their rented rooms in Ho

Chi Minh City did not have too much difficulty connecting to the synchronous classes, the instability in Internet connection was one factor that distressed the students who were staying in their hometown in the countryside or the quarantine area. The students who lived in the cities also had technical problems at peak hours when other members were also using the Internet: "I sometimes felt annoyed when my brother turned on his phone and played video games, because my Zoom account started to log out again and again" (student G). The students also reported that they are highly anxious when looking at other people having technical problems during the listening exam time: "It was not my case, but it was my friend. She lost her Internet connection during the listening test. She cannot hear anything at all, and she failed the test" (student F). Thus, although the students who lived at home or at their rental apartment in the city did not directly admit that technology was one contributor to academic burnout, they still reported feeling "distressed," "annoyed," or "anxious" at times due to factors related to the Internet connection.

On the other hand, students who were in the quarantine zones or live in the countryside reported severe burnout due to the low-quality technical facility and Internet connection. Student A shared that "The Internet is not stable and the signal is weak, so this is the most stressful time in my life!... I studied on my bed with only my phone and it always got overheated. It was not until I took the test that I had a laptop sent in my friend." Likewise, student C said that "My quarantine zone had low-quality facilities. I had to use 4G to study six to seven hours continuously. My phone screen was too small and I was very depressed when I had to read a lot of information in the teacher slides. I could not do the reading practice as well because the text was illegible." Similarly, student E who was living in the highland, said that "I feel much more emotionally drained and physically exhausted dealing with the faulty phone and unstable Internet connection. There is no technician to support me here." "Sometimes, I just wanted to give up. I don't care whether I can enter the session or not. It is just like it does not matter anymore." All the participants agreed that the limitations of technical families exhausted them both physically and mentally, which in turn led to their academic burnout.

The teachers and school administrators were also aware of and sympathetic toward the students' insufficient technical conditions for online learning, leading to their academic burnout. Teacher A shared that "More than 20% of the students in my class did not have favorable conditions regarding facilities, the Internet, and the environment. I think this made them physically and psychologically exhausted. They seem burned out all time." Likewise, teacher B also agreed that "My students told me that sometimes they did not want to study the Internet in their areas was in bad quality." The administrators agreed that facilities were of utmost importance for online learning. According to administrator B, not all students in Vietnam had a laptop, and it was inconvenient to study by phone. Manager A added that "It is up to each student's conditions in terms of facilities. Online learning can only succeed with the optimal technical facility of the institution, teachers, and students."

Learning Management System and Online Conference Applications

Regarding the school's system, the students reported that classrooms were built on a Learning Management System (LMS) where the teachers posted the link to their virtual classes and the link to the recorded video of each lesson. The materials, the presentation slides, and assignments were also uploaded there. However, the students sometimes found the system unnecessary. Student D questioned the practicality of the content of the activities on the LMS, saying that "the activities on the LMS system just harshly copy all the activities in the course book that we learn in our face-to-face class. Although our school is very reputable, the LMS system cannot meet my expectations at all." The case was also true for student B when she said that "I was burnout after spending the whole day in front of the computer studying. I was just indifferent toward all the activities there [on the LMS]. I wouldn't have done them if the teacher had not forced us to." Students even felt more burnout when there were technical problems with the LMS. Student A said that she was afraid of "achieving nothing and losing her scores" when the LMS was like to "crash whenever it likes" when student D felt that she could "achieve less in comparison to doing more meaningful exercises with friends in the face-to-face class." Both teachers A and B agreed that one factor of "great concern" was the frequent crash of the LMS system. According to teacher B, "The school LMS has gone down often. They seem very stressed having to seek technical support regularly."

In addition to the LMS system, the online conference platforms also contributed to the students' burnout in the EFL online classes. Student F said that at the beginning of the course, she spent hours in vain trying to log into the synchronous sessions with Microsoft Team, and at the end, she just felt like "quitting," thinking that "I should have taken a nap instead." Students A and B thought that online learning during the pandemic was more "demonstrative than really effective" because after the students had to spend an extended period trying only to log into the system "just to find that the class has ended before we are in," they tended to "skip other courses because they are all the same. It [the MS Teams application] is slow and often gets lagged. It is time-consuming and fruitless."

Rules and Regulations
Prolonged Online Learning Schedule
The fact that the university transferred the entire face-to-face class schedule into an online class schedule dramatically enhanced the students' exposure to the computer screen, high burnout level, and particular mental, physical, and psychological fatigue. Student B complained that staring at the phone screen continuously caused eyestrains because the learning schedule assigned by the university was not "sensible," and thus, there were some days that he had to work on the phone "for at least 12 hours continuously." Likewise, all six students reported having migraine or headaches at least once a week due to the prolonged exposure to the blue light emitted by the monitor screen or their phone screen. Also, student G reported that she had a light backache every day after class while student G said that he "felt

like an old woman who cannot concentrate on anything after spending ten hours studying in front of the computer," or even become forgetful when she has to study for the online exams.

Attendance Checking and Privacy Concerns

In addition to the regulations about study time, students also showed negative attitudes toward the in-class requirement established by the teacher *per se*. While some teachers allowed students to turn on webcam and microphone when necessary only, other teachers forced the students to keep their webcams and microphones on "24/24" (student B), which heightened their "embarrassment," "discomfort," "annoyance," or even "depression" among the students as complained by five out of seven students. Student A revealed her situation during the time as a communal quarantine zone, stating that "I did not dare to use [my] webcam and mic because I felt embarrassed speaking English with many people around." More noticeably, student D believed that teachers "have no right to intrude [his] privacy, as I am over 18 years old and no one should force me to reveal my personal space." In the same vein, student G believed that turning on the webcam during the whole session "disturbs the whole family" because without a study room, she had to study in the living room where everyone usually had quality time together and now "they have to give up on doing things with each other and retreat into their rooms."

The regulations also caused misunderstandings or even conflicts. Student A reported that "I can't understand why my teachers keep doing the roll call twice or even three times in one learning session. It made me exhausted, I always felt tensed because I didn't know when he would call on me." When student D lost the Internet connection and turned off webcam, the lecturer reduced his attendance score without listening to his explanation. Student D lost all of his study interest right after that incident, saying that "He was not listening. I do not think studying should be such a torture." Likewise, student F confirmed that "I could not attend the lessons [due to the account problem], so I lost the chance to gain bonuses for participation. I was worried that my score would be low this semester."

Online Behavior, Etiquette, and Cyber-Bullying

Also, there was a severe lack of codes of conduct and online learning etiquettes because the students were unprepared for the sudden transformation to online learning. Thus, students at times did not know how to behave in the classroom appropriately. Student E said that she "burst out into tears" when she heard one male student in the class comment about her appearance in a highly hostile and insulting manner as he forgot to turn off his microphone. Student G also shared that cyberbullying sometimes existed in the online classroom as two male students kept on laughing at her teammate's pronunciation when they were presenting. Student G said that her friend "turned off the Google Meets right after the presentation" because that student felt she "cannot achieve anything in an online class besides humiliation and embarrassment." Student A also shared that she wanted to withdraw in the middle of the course because she "could not study well," and the online class was "different from speaking up in offline classes because everyone was very attentive

to my voice. People will hear and recognize our mistakes. Other students even recorded our voice and mimicked us to poke fun at our accent."

Online Exam Regulations

One of the factors causing students burnout with online learning in the ELT classes was the regulations related to testing and examinations. As the exams took place online, the students believed that the regulations were not strict enough to prevent cheating, which was unfair for the students who worked hard. Student B said that he lost his sense of personal achievement, a dimension of academic burnout because he knew that many students cheated in the test. According to student B, the school could not monitor the students in the online exam, and many students "secretly contact each other on *Telegram* or *Zalo* to share the answer key." Student B believed that the test "failed to measure correctly how hard-working each student was" and it was not "worth our efforts." Also, students D and E believed that as students in the different classes had different exam content, it was unfair for them because "some test packages were easier than others," which made them think that "learning doesn't matter much; it is your good luck that matter." Also, as most of the tests were in the form of multiple choice quizzes, student D wondered if they could test their language competence. He added that "I don't think the multiple-choice questions are necessary for our future work. What we need is how to use English in real life, not only ticking the correct grammar point and lexical items."

Division of Labor
Teacher Roles

Interviews with the students revealed that teachers played an essential role in helping students overcome their burnout state. Students A, B, and C believed that teachers were very "caring," "thoughtful," and "considerate" during the online EFL courses. "The teachers always reminded the students about the links to the synchronous sessions before each lesson" said student A. According to student B, the teachers also usually spent time asking about the students' family and health and encouraged them to "think positively" and overcome the COVID-19 together, particularly for those infected with the Coronavirus. Also, student B believed that she could communicate with teachers more easily when studying online because she could "text what we think" while she would feel shy when talking to the teacher face-to-face. Thanks to the teachers' efforts, students were "more excited" and "less alone" during shutdowns and lockdowns (student C). Teachers were also very understanding toward the student objective issues, for example, when they were called out for a community-based Coronavirus test and had to quit zoom sessions (student F). This aligns with what teachers B and C shared as they thought their instruction was very "clear, detailed, and supportive." Teacher C even reminded the students to go to the correct link before every lesson and "posted the materials students requested... Students who did not attend any classes might go [to the LMS] to download materials."

However, sometimes students reported a change in the division of labor from the teachers' side that heightened the students' academic burnout. "It seemed like the teacher did not run their lesson as smoothly as they usually did in the offline class, and thus, we felt a little disheartened to come to class," student D and student C stated. Most teachers were not well prepared enough to teach online EFL classes in such an emergency as the COVID-19 pandemic. Teacher A confirmed that they "tried best" to transfer the "leftovers" of the face-to-face program to the online EFL class. However, both teachers A and B said that all university teachers had only taught the offline class before the pandemic broke out. "Without adequate training of how to teach with technology tools and applications, we realized that some students lost their interest in coming to class."

Students B, E, F, and G agreed that teacher talking time in a lesson increased tremendously in the online classroom as "sometimes the teacher asked but no one replied." Also, as some teachers might feel ignored by the students, they were inclined to feel disrespected and become emotionalist with their teaching. Consequently, the class becomes a "cold war" (student D). Student C said that "when nobody replied to the teacher, she started to feel stressed. And then the whole lesson started to be stressful because both the teacher and the students did not care about what each other was doing anymore." One teacher complained that "some students just copied and pasted when I raised the questions. They did not realize they had to communicate to improve their English." Another teacher added that "some students went online searching for the answers. They did not even bother to think and speak. I couldn't force them to speak in the online class which is opposite in the offline sessions."

Institutional Roles

While all students in the interview believed that the university provided students with fundamental administrative support ranging from the learning regulations, coursebooks, and examination guidelines, the school administrative process was slower than students expected. "It is hard for me to contact the school administrative in case of emergencies since it takes one to two weeks for them to reply to our email." (student A). Some students became more mentally exhausted when they had to when through bureaucratic procedures to fix their online account problem, but after all, the problem was still not fixed (student F).

Furthermore, students think that the school did not take a proactive role in helping students in solving emotional problems, especially when they feel burned out. Student A reported that "Except for the delivery of the course, I did not notice any support from the school. There were just some Facebook posts to encourage us. That is all." Student D said that "It is different in our country than in other countries. Psychologists and consultants are not popular in university. I wish we had this form of support here as they do in Western countries." In contrast, administrator B insisted that "the school had psychological consulting service," although few students knew of this service. She added that "I think the school should require the teachers to inform the students and remind them to turn to the school consultant frequently to reduce their burnout rather than keep the tension to themselves." She also suggested that "online consultant can be incorporated to the LMS system, so that students may quickly access the service in times of crisis."

Community
Family and Roommates

Similarly, although all three students who studied from home reported some level of distractions, such as, presence of other family members, unavoidable household chores, and their pets (student G), the students did not feel that these factors heightened their academic burnout. Student B reported: "While studying at home, I cannot stay at the same place and concentrate as I did in class. I was interrupted by people around." However, when she explicitly expressed her annoyance, her family became more attentive to her study time and did not disturb her anymore. In fact, all students who had to study online while living with family highly appreciated the family's role in alleviating burnout and stress through encouragement and caring actions (student G and student B). As regards students who were living in a rental room with the friends, they also received words encouragement and established mutual understanding. Because they were all "students," they "sympathize[d] with each other" and were "supportive of each other." Likewise, in the quarantine zone, although other roommates and medical staff "got in and out frequently," they understand that she was studying and "tried their best not to disturb me" (student A). The students did not think that the community at the quarantine zone increased her academic burnout. In contrast, the roommates were understanding and respected their study time.

Online Social Networking Communities

As all the extracurricular activities were not allowed to take place offline, all students' social calendar was changed into online activities with the online groups on *Facebook, Twitter*, and *Zalo*. The online social networking groups both positively and negatively impacted learners' burnout levels. First of all, there were many online competitions and social campaigns conducted by the youth association of the university, which helped the student to "de-isolate and improve English" (student D). Student D thought that "the funny English memes that the schools share online really helped the students to burst out laughing. They were like an emotional recharge." After attending the online mini-games and competitions hosted by the schools, student G felt an improvement of English, and thus "a burst of adrenaline" and "a heightened sense of self achievement." She believed that "What the teachers taught me was not useless at all." These online social networking sites were indeed an aspect of life with which the students could release their stress, feel more connected, treasure their self-achievement, and minimize their burnout level.

However, social networking sites also had adverse effects on students learning and increased their burnout state. First, spending too much time on social networking sites like

Facebook, *Twitter*, or *TikTok* also contributed to the physical exhaustion of the students. Student B said that "I didn't need to be punctual, so I can stay up until 2 a.m. chatting and playing online games with my friends. I could just sign in, and after that I could have my breakfast. Without the teacher's observation, sometimes I slept during the lesson because I was too tired." Although student B "didn't feel burnout at first," as the course passed by he felt "a little physically exhausted" and became more "absorbed in surfing Facebook and Instagram" and "learning English didn't matter much because the teacher couldn't know what we were doing." Student C was also burned out due to some conflicts with his friends on social networking sites which influenced his learning performance. Administrator A added that "If a course was appropriately organized and the students were self-disciplined, there would be no problems. However, without the students' self-discipline, the learning process cannot take place regardless of how well-prepared the teachers and the university are."

DISCUSSION

Factors Influencing English as a Foreign Language Learners' Physical and Psychological Exhaustion

First, regulations about prolonged online learning time created physical and mental fatigue among the participants. While the school had to transfer from face-to-face class to online learning and teaching, there was no modification in the schools' bell routine that required the students to be in class for an extended period. Although a previous study by Turchi et al. (2020) concludes that teachers may have problems maintaining consistency in time allotments when the school does not apply the bell schedule to the online class, our finding signifies that transferring an entire offline school schedule to online mode of learning and teaching exhausted students mentally and physically. The fact that students had to spend approximately 10–12 h studying in front of their smart devices is worrying as it can trigger numerous health issues, which is supported by Fauville et al. (2021). Common health-related problems like headaches, migraine, backache, or shortened attention span are symptoms of digital fatigue, contributing to heightened stress and burnout among adolescents. This finding is in line with other studies about the effects of smart devices on physical and mental wellbeing (Lemola et al., 2015; Mheidly et al., 2020). The administrators and educators need to acknowledge this inherent problem related to prolonged exposure to the computer screen and implement possible measures to help students prevent academic exhaustion. On a macro-scale, the authority should implement guidelines for the number of sessions and duration of online classes that are based on scientific research in education, psychology, and digital wellbeing. While many countries, for example, India (Department of School Education and Literacy, 2020) or Vietnam (Ministry of Education and Training, 2021), have issued

guidelines and laws to regulate online learning time amidst the COVID-19 pandemic, most of these documents focused on primary school to high school students. The government and the tertiary educational institute need to join hands and examine the optimal learning times for the undergraduates. On an institutional scale, the university can allow students to choose their study time according to their own needs (Turchi et al., 2020; Tafazoli and Atefi Boroujeni, 2021) or introduce longer intervals between synchronous sessions where students can conduct healthy practices like a breathing exercise (Mheidly et al., 2020).

Also, privacy concerns and cyberbullying contributed to EFL learners' psychological exhaustion. The fact that students had to turn on their webcam as proof of attendance puts them under constant threat of privacy intrusion and cyberbullying. The findings in this study testify of the adverse effects of the webcam and microphone on students' psychological variables, notably resulting in their psychological exhaustion. Our findings partially align with Maimaiti et al. (2021), stating that turning on the camera creates peer pressure. However, while the research by Maimaiti et al. (2021) concludes that webcam is essential for students to concentrate, our findings show that without a well-established common code of conduct and mutual understanding of online learning cultures, webcam and microphone are detrimental to the EFL learners' emotion and mental health. The fear of losing face and being ridiculed on the grounds of internal factors, such as accent, appearance, and linguistic competence, or external factors, such as the conversations between family members and family financial background, should not be neglected. The ethical question here lies in how to create an effective learning and teaching environment and a secure place so that no students are afraid of being harmed in cyber space, as insecurity, indeed, is perceived by the students as a fundamental factor causing high academic burnout levels. Therefore, schools and teachers must introduce a code of conduct in online learning and mechanical and technical measures from the university's technicians to protect the student the students are learning online.

In addition, the division of labor by teachers and the university also affects learners' exhaustion. During the COVID-19 pandemic, teachers took a proactive role in supporting students by asking about their health or encouraging them to think positively. Also, when learning, the students found that they could communicate with the teacher without shyness thanks to texting applications, which also open up more opportunities for them to seek emotional support. These findings elucidate the mechanism of how affective support can inhibit burnout among EFL students. This study confirms the study with 306 EFL Italian learners by Karimi and Fallah (2021), which explains the negative correlation between affective support from teachers and ELF learners' academic burnout through structural equation modeling. Unfortunately, not all teachers were perceived as supportive in our research. As teachers were also likely to feel burnout in the COVID-19 pandemic (Sokal L. J. et al., 2020; Pressley, 2021), they might redirect their distress toward the students. The fact that students were not communicative in online classes might also put more

pressure on the teacher, which enhanced their professional burnout. Some teachers resorted to silent treatment instead of choosing different strategies to support the students. According to Yoon and Kerber (2003), the silent treatment is a form of bullying that is detrimental to the victims. The use of silent treatment in online classrooms can exacerbate both sides' burnout state. The teachers should consider other approaches to enhance the learners' communication. Also, as some EFL learners are not proficient enough to explain themselves and their English issues, code-switching should be allowed in the classroom.

The university's delays in helping students solve their problems was also a factor that worsened the student burnout states. While there is still a limited body of studies connecting the lengthy administrative procedures from the school to the academic burnout, it is possible that as students could only contact the schools via phones or emails during the COVID-19 pandemic, the waiting time might create more anxiety as they could get into a class or might not be able to enter the test room timely. Also, while the school administrators insisted that psychology consulting services were available for students, most of the students did not know of this source of support. One student thought that this service was only available in developed countries or Western countries. The students' unawareness of the school psychologists calls for a more proactive role from the school to inform students of the support network that they are entitled to so that the students can adopt a more holistic approach to coping with stress and academic burnout.

The content analysis also reveals that communities, including family and friends, quarantine zone, and social networking also affected EFL learners' exhaustion. Understanding parents, roommates, or the community at the quarantine zones are the support network that EFL learners can depend on when they feel exhausted. Although there is limited research into the effect of support from friends, parents, and other communities on academic burnout, Kim et al. (2018) and Renk and Smith (2007) suggest that support by others can reduce students' academic-related stress. In addition, social networking communities have a double-edged effect on students' academic burnout. Students in our study perceived the moderate use of social networking sites as a place to deisolate and provide them with an emotional recharge as all extracurricular and social activities had been transferred to the online environment. Our findings are in line with Wang et al. (2014), in which 377 undergraduates from universities in Southwestern China participated in a survey to examine the relationship between social networking sites and their wellbeing. According to Wang et al. (2014), social networking sites' communication function positively correlates with students' subjective wellbeing. On the other hand, the participants in our study also reported that the excessive use of social networking platforms, especially overnight, created fatigue in class the next day, thus enhancing their burnout level. As many medical and psychology studies into the use of smart devices in bed also report that using smartphones before sleep decreases both happiness and wellbeing (Hughes and Burke, 2018; Alonzo et al., 2021), our study adds that the overuse of smartphones can create student exhaustion and increase their academic burnout.

Factors Influencing English as a Foreign Language Learners' Academic Cynicism

Teachers' insufficient preparation for online teaching was one factor that affected EFL learners' academic cynicism. In fact, the under-preparedness of teachers to conduct online teaching has been recorded both before and during the outbreak of the COVID-19 pandemic (Stockwell and Reinders, 2019; Rapanta et al., 2020; Pressley, 2021). However, previous studies have not examined how teacher unpreparedness can affect student burnout. Therefore, the findings in this study added that, from the student perspective, the fact that teachers were not well-prepared enough to teach online might create academic cynicism among students. Students did not perceive that teachers are well-qualified enough to teach online, so they were discouraged from joining the online class. Although teacher preparation is paramount for student academic achievement (Boyd et al., 2009), the outbreak of COVID-19 and the forced shift to online teaching are creating a false sense of unpreparedness which creates a feeling that we are strange to the use of technology in teaching and learning (Harouni, 2021). However, the question is whether teachers can only perform thanks to training, planning, and preparation effectively. Rather than always feeling unprepared and losing confidence in teaching, which can lead to cynicism of both teachers and students, teachers should remind themselves that teaching and learning have always contained uncertainties and unpreparedness. Admittedly, even before the COVID-19 pandemic, many teachers and students had been used to computers, smartphones, and social networking sites. Thus, what is making the teachers unprepared may not be the digital tools but rather their mindset. Therefore, besides providing teachers with training, institutions should help teachers recognize that they "have learned [how to teach] without feeling prepared" (Harouni, 2021, p. 4). By overcoming their unconfidence regarding the desire to be constantly prepared, teachers can reflect on what they know about pedagogy in general and improvise in the new learning and teaching context. This radical idea of pedagogy may help teachers feel ready to emerge in the digital world and thus reduce learners' cynicism.

Studies have proven a relationship between burnout and cheating. Students with high academic burnout tend to cheat more in exams (Kusnoor and Falik, 2013). Specifically, academic cynicism, a factor of academic burnout, positively correlates with cheating in the academic environment (Ameen et al., 1996; Ugwu et al., 2013; Nasu and Afonso, 2020). However, within this study, not only was cheating a sign of academic burnout inside the cheater *per se*, it also affected other students. As it was too easy to cheat in an online exam, students would develop their academic cynicism, believing that putting efforts into authentic learning was not as conducting misdeeds to achieve high scores. It is important to implement both a high-tech cheating detector system and low-cost measures to prevent this malpractice to become a pandemic that spread the cynicism virus to all students in the online class. The school can make more investment in software, such as eye-tracking, screen monitoring, or other web-based anti-cheating systems. The school must disseminate the code of academic integrity among students

that includes the online learning environment. Also, penalty for cheating should be high enough to prevent reoccurrence (D'Souza and Siegfeldt, 2017).

Factors Influencing English as a Foreign Language Learners' Sense of Academic Achievement

The first factor that positively influenced EFL learners' sense of achievement was their active participation in extra curricular activities on social networking sites. With online activities and competitions on Facebook or Twitter, students could use their English in real-life rather than outside the classroom. As students could use English in competitions with their friends on Facebook, they recognized that the English they learned from the class was not useless, which was proof of academic achievement. This evidence of language acquisition was well-perceived by the students, thus solidifying their sense of academic achievement. Also, as many games were competitive with different levels of difficulties, students would feel that they had achieved a higher level of language competence by winning the games. These findings are supported by Vandercruysse et al. (2013). In the article by Vandercruysse et al. (2013), students working in a more competitive environment like the game-based ones often reported higher perceived linguistic competence, more task value, and increased invested effort. It is worth noting here that the COVID-19 opens new opportunities for language teaching and learning as the researchers, administrators, and teachers can observe that through the design and incorporation of mini-games on social networking sites. This implementation of game-based language activities on official university Facebook or Twitter groups can be sustained as a supplementary even after the COVID-19 pandemic to support EFL learners' language acquisition.

In contrast, two factors, including attendance checking and exam regulations, negatively impacted students' sense of academic achievement. As the Internet connection of some learners was not stable, it would be unfair if the teacher reduced the learners' score because he had to attend a compulsory communal COVID-19 test. The reduction of learners' score due to their inability to answer during a roll call can be subjective and discouraging. Instead, teachers can use other methods of formative assessment such as portfolio or take-home project with negotiable deadlines so that students can obtain their improvement over time and feel an increased sense of self-achievement (Khan, 2006). Also, sitting an online synchronous exam full of multiple-choice questions is risky and unreflective of the EFL learners' competence. First, if the students' score is affected by technical issues, the student sense of achievement will be reduced. Also, as the students reported, they did not feel many relations between the test and their actual ability to communicate in English or apply English to their future work. Therefore, instead of synchronous grammar and vocabulary-based exams, the teachers should consider project-based

or task-based assessments to assess the learner's linguistic competence multilaterally.

CONCLUSION

The research revealed that the participants perceived four dimensions of the CHAT framework, including mediating artifacts, community, rules and regulations, and division of labor as the most dominant factors contributing to the EFL learners' academic burnout in online classes during the COVID-19 pandemic. Within the four overarching dimensions, five areas that impacted EFL learners' physical and psychological exhaustion were prolonged online learning time, privacy concerns and cyber-bullying, teachers' role, institution's role, and support community outside the classroom. Also, teachers' insufficient preparation for online teaching and students' academic misconduct during exams were aspects causing academic cynicism among the learners. Also, while participation in social networking sites' extracurricular activities had both positive and negative effects on students' sense of achievement, participation in checking and cheating in exams exacerbated this last dimension of academic burnout. Acknowledging the root causes of academic burnout, the government, school management, and educator can introduce policies and modify the teaching and learning program and other related aspects to online EFL teaching in an emergency. While the authors tried their best to report what the participant shared unbiasedly, we have to admit that we cannot fully account for the difficulties and losses that students have been through during the COVID-19 pandemic. In the future, other researchers can continue with factors affective teachers' or administrators' burnout or compare the matches and mismatches between different perspectives about what burnout could result from in a more general educational context.

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by HQT Education's Research Ethics Board. The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

All authors listed have made a substantial, direct, and intellectual contribution to the work, and approved it for publication.

REFERENCES

Alonzo, R., Hussain, J., Stranges, S., and Anderson, K. K. (2021). Interplay between social media use, sleep quality, and mental health in youth: a systematic review. *Sleep Med. Rev.* 56:101414. doi: 10.1016/j.smrv.2020.101414

Ameen, E. C., Guffey, D. M., and McMillan, J. J. (1996). Accounting students' perceptions of questionable academic practices and factors affecting their propensity to cheat. *Account. Educ.* 5, 191–205. doi: 10.1080/09639289600000020

Arroyo, A. T., Kidd, A. R., Burns, S. M., Cruz, I. J., and Lawrence-Lamb, J. E. (2015). Increments of transformation from midnight to daylight: how a professor and four undergraduate students experienced an original philosophy of teaching and learning in two online courses. *J. Transformat. Educ.* 13, 341–365. doi: 10.1177/1541344615587112

Balogun, J. A., Hoeberlein-Miller, T. M., Schneider, E., and Katz, J. S. (1996). Academic performance is not a viable determinant of physical therapy students' burnout. *Percept. Mot. Skills* 83, 21–22. doi: 10.2466/pms.1996.83.1.21

Behr, D. (2017). Assessing the use of back translation: the shortcomings of back translation as a quality testing method. *Int. J. Soc. Res. Methodol.* 20, 573–584. doi: 10.1080/13645579.2016.1252188

Bolatov, A. K., Seisembekov, T. Z., Askarova, A. Z., Baikanova, R. K., Smailova, D. S., and Fabbro, E. (2021). Online-learning due to covid-19 improved mental health among medical students. *Med. Sci. Educ.* 31, 183–192. doi: 10.1007/s40670-020-01165-y

Bottiani, J. H., Duran, C. A. K., Pas, E. T., and Bradshaw, C. P. (2019). Teacher stress and burnout in urban middle schools: associations with job demands, resources, and effective classroom practices. *J. Sch. Psychol.* 77, 36–51. doi: 10.1016/j.jsp.2019.10.002

Bowen, G. A. (2008). Naturalistic inquiry and the saturation concept: a research note. *Qual. Res.* 8, 137–152. doi: 10.1177/1468794107085301

Boyd, D. J., Grossman, P. L., Lankford, H., Loeb, S., and Wyckoff, J. (2009). Teacher preparation and student achievement. *Educ. Eval. Policy Anal.* 31, 416–440. doi: 10.3102/0162373709353129

Brantlinger, E., Jimenez, R., Klingner, J., Pugach, M., and Richardson, V. (2005). Inhibition, integrity and etiquette among online learners: the art of niceness. *Except. Child.* 71, 195–207. doi: 10.1177/001440290507100205

Conrad, D. (2002). Inhibition, integrity and etiquette among online learners: the art of niceness. *Distance Educ.* 23, 197–212. doi: 10.1080/0158791022000009204

Department of School Education and Literacy (2020). *Guidelines for Digital Education*. Available online at: https://diksha.gov.in/ncert/get (accessed December 2, 2021).

D'Souza, K. A., and Siegfeldt, D. V. (2017). A conceptual framework for detecting cheating in online and take-home exams. *Decis. Sci. J. Innov. Educ.* 15, 370–391. doi: 10.1111/dsji.12140

Engeström, Y. (1987). *Learning by Expanding: An Activity-Theoretical Approach to Developmental Research*. Helsinki: Orienta-Konsultit Oy.

Engeström, Y., and Sannino, A. (2010). Studies of expansive learning: foundations, findings and future challenges. *Educ. Res. Rev.* 5, 1–24. doi: 10.1016/j.edurev.2009.12.002

Fauville, G., Luo, M., Queiroz, A. C. M., Bailenson, J. N., and Hancock, J. (2021). Zoom exhaustion & fatigue scale. *Comput. Hum. Behav. Rep.* 4:100119. doi: 10.1016/j.chbr.2021.100119

Frey, B. B. (ed.) (2018). "Pragmatic paradigm," in *The SAGE Encyclopedia of Educational Research, Measurement, and Evaluation*, (New York, NY: SAGE Publications, Inc). doi: 10.4135/9781506326139.n534

Harouni, H. (2021). Unprepared humanities: a pedagogy (forced) online. *J. Philos. Educ.* 55, 633–648. doi: 10.1111/1467-9752.12566

Hughes, N., and Burke, J. (2018). Sleeping with the frenemy: how restricting 'bedroom use' of smartphones impacts happiness and wellbeing. *Comput. Hum. Behav.* 85, 236–244. doi: 10.1016/j.chb.2018.03.047

Jacob, S., and Furgerson, S. (2015). Writing interview protocols and conducting interviews: tips for students new to the field of qualitative research. *Qual. Rep.* 17, 1–10. doi: 10.46743/2160-3715/2012.1718

Jacobs, S. R., and Dodd, D. (2003). Student burnout as a function of personality, social support, and workload. *J. Coll. Stud. Dev.* 44, 291–303.

Kao, Y. T. (2020). Understanding and addressing the challenges of teaching an online CLIL course: a teacher education study. *Int. J. Biling. Educ. Biling.* 25, 656–675. doi: 10.1080/13670050.2020.1713723

Karimi, M. N., and Fallah, N. (2021). Academic burnout, shame, intrinsic motivation and teacher affective support among Iranian EFL learners: a structural equation modeling approach. *Curr. Psychol.* 40, 2026–2037. doi: 10.1007/s12144-019-0138-2

Khan, B. H. (ed.) (2006). "Flexible learning in an information society," in *Flexible Learning in an Information Society*, (Hershey, PA: IGI Global). doi: 10.4018/978-1-59904-325-8

Khlaif, Z. N., Salha, S., and Kouraichi, B. (2021). Emergency remote learning during COVID-19 crisis: students' engagement. *Educ. Inf. Technol.* 26, 7033–7055. doi: 10.1007/s10639-021-10566-4

Kim, B., Jee, S., Lee, J., An, S., and Lee, S. M. (2018). Relationships between social support and student burnout: a meta-analytic approach. *Stress Health* 34, 127–134. doi: 10.1002/smi.2771

Kim, B., Kim, E., and Lee, S. M. (2017). Examining longitudinal relationship among effort reward imbalance, coping strategies and academic burnout in Korean middle school students. *Sch. Psychol. Int.* 38, 628–646. doi: 10.1177/0143034317723685

King, N., and Horrocks, C. (2010). *Interviews in Qualitative Research*. London: Sage.

Kusnoor, A. V., and Falik, R. (2013). Cheating in medical school: the unacknowledged ailment. *South. Med. J.* 106, 479–483. doi: 10.1097/SMJ.0b013e3182a14388

Lemola, S., Perkinson-Gloor, N., Brand, S., Dewald-Kaufmann, J. F., and Grob, A. (2015). Adolescents' electronic media use at night, sleep disturbance, and depressive symptoms in the smartphone age. *J. Youth Adolesc.* 44, 405–418. doi: 10.1007/s10964-014-0176-x

Leontiev, A. N. (1978). *Atividade, Consciência e Personalidade*. Buenos Aires: Ciencias Del Hombre.

MacIntyre, P. D., Gregersen, T., and Mercer, S. (2020). Language teachers' coping strategies during the Covid-19 conversion to online teaching: correlations with stress, wellbeing and negative emotions. *System* 94:102352.

Maimaiti, G., Jia, C., and Hew, K. F. (2021). Student disengagement in web-based videoconferencing supported online learning: an activity theory perspective. *Interact. Learn. Environ.* 1–20.

Maslach, C., Schaufeli, W. B., and Leiter, M. P. (2001). Job burnout. *Annu. Rev. Psychol.* 52, 397–422. doi: 10.1146/annurev.psych.52.1.397

May, R. W., Bauer, K. N., and Fincham, F. D. (2015). School burnout: diminished academic and cognitive performance. *Learn. Individ. Dif.* 42, 126–131. doi: 10.1016/j.lindif.2015.07.015

Mheidly, N., Fares, M. Y., and Fares, J. (2020). Coping with stress and burnout associated with telecommunication and online learning. *Front. Public Health* 8:574969. doi: 10.3389/fpubh.2020.574969

Ministry of Education and Training (2021). *Quy định về quản lý và tổ chức dạy học trực tuyến trong cơ sở giáo dục phổ thông và giáo dục thường xuyên*. Available online at: https://moet.gov.vn/content/tintuc/Lists/News/Attachments/7284/09 2021TT BGDDT THÔNG TƯ DẠY HỌC TRỰC TUYẾN.PDF

Misirli, O., and Ergulec, F. (2021). Emergency remote teaching during the COVID-19 pandemic: parents experiences and perspectives. *Educ. Inf. Technol.* 26:6699–6718. doi: 10.1007/s10639-021-10520-4

Nasu, V. H., and Afonso, L. E. (2020). Relationship between cynicism and expected cheating in academic and professional life: a study involving lato sensu graduate students in accounting. *J. Educ. Res. Account.* 14, 352–370.

Noh, H., Chang, E., Jang, Y., Lee, J. H., and Lee, S. M. (2016). Suppressor effects of positive and negative religious coping on academic burnout among korean middle school students. *J. Relig. Health* 55, 135–146. doi: 10.1007/s10943-015-0007-8

Peper, E., Wilson, V., Martin, M., Rosegard, E., and Harvey, R. (2021). Avoid zoom fatigue, be present and learn. *Neuroregulation* 8, 47–56. doi: 10.15540/NR.8.1.47

Portoghese, I., Leiter, M., Maslach, C., Galletta, M., Porru, F., D'Aloja, E., et al. (2018). Measuring burnout among university students: factorial validity, invariance, and latent profiles of the italian version of the Maslach Burnout Inventory Student Survey (MBI-SS). *Front. Psychol.* 9:2105. doi: 10.3389/fpsyg.2018.02105

Pressley, T. (2021). Factors contributing to teacher burnout during COVID-19. *Educ. Res.* 50, 325–327. doi: 10.3102/0013189X211004138

Rapanta, C., Botturi, L., Goodyear, P., Guàrdia, L., and Koole, M. (2020). Online university teaching during and after the Covid-19 crisis: refocusing teacher

presence and learning activity. *Postdig. Sci. Educ.* 2, 923–945. doi: 10.1007/s42438-020-00155-y

Renk, K., and Smith, T. (2007). Predictors of academic-related stress in college students: an examination of coping, social support, parenting, and anxiety. *NASPA J.* 44, 405–431. doi: 10.2202/1949-6605.1829

Salanova, M., Llorens, S., García-Renedo, M., Burriel, R., Bresó, E., and Schaufeli, W. B. (2005). Toward a four-dimensional model of burnout: a multigroup factor-analytic study including depersonalization and cynicism. *Educ. Psychol. Meas.* 65, 901–913. doi: 10.1177/0013164405275662

Samara, O., and Monzon, A. (2021). Zoom burnout amidst a pandemic: perspective from a medical student and learner. *Ther. Adv. Infect. Dis.* 8:204993612110267. doi: 10.1177/20499361211026717

Schaufeli, W., Leiter, M., and Maslach, C. (2009). Burnout: 35 Years of research and practice. *Career Dev. Int.* 14, 204–220. doi: 10.1108/13620430910966406

Sokal, L., Trudel, L. E., and Babb, J. (2020). Canadian teachers' attitudes toward change, efficacy, and burnout during the COVID-19 pandemic. *Int. J. Educ. Res. Open* 1:100016.

Sokal, L. J., Trudel, L. G. E., and Babb, J. C. (2020). Supporting teachers in times of change: the job demands- resources model and teacher burnout during the COVID-19 pandemic. *Int. J. Contemp. Educ.* 3, 67–74. doi: 10.11114/ijce.v3i2.4931

Stetsenko, A., and Arievitch, I. M. (2004). The self in cultural-historical activity theory: reclaiming the unity of social and individual dimensions of human development. *Theory Psychol.* 14, 475–503. doi: 10.1177/0959354304044921

Stockwell, G., and Reinders, H. (2019). Technology, motivation and autonomy, and teacher psychology in language learning: exploring the myths and possibilities. *Annu. Rev. Appl. Linguist.* 39, 40–51. doi: 10.1017/S0267190519000084

Suri, H. (2011). Purposeful sampling in qualitative research synthesis. *Qual. Res. J.* 11, 63–75. doi: 10.3316/QRJ1102063

Tafazoli, D., and Atefi Boroujeni, S. (2021). Legacies of the COVID-19 pandemic for language education: focusing on institutes managers' lived experiences. *J. Multicult. Educ.* 16, 30–42. doi: 10.1108/JME-08-2021-0161

Thorne, S. L. (2000). "Beyond bounded activity systems: heterogeneous cultures in instructional uses of persistent conversation," in *Proceedings of the 2000 Annual Hawaii International Conference on System Sciences*, Maui, HI, 1–11.

Turchi, L. B., Bondar, N. A., and Aguilar, L. L. (2020). What really changed? Environments, instruction, and 21st century tools in emergency online English language arts teaching in United States schools during the first pandemic response. *Front. Educ.* 5:583963. doi: 10.3389/feduc.2020.583963

Ugwu, F. O., Onyishi, I. E., and Tyoyima, W. A. (2013). Exploring the relationships between academic burnout, self- efficacy and academic engagement among Nigerian college students. *Afr. Symp.* 13, 37–45.

UNESCO (2020). *COVID-19: How the UNESCO Global Education Coalition is Tackling the Biggest Learning Disruption in History*. Available online at: https://en.unesco.org/news/covid-19-how-unesco-global-education-coalition-tackling-biggest-learning-disruption-history (accessed December 6, 2021).

van Lier, L. (2004). The ecology and semiotics of language learning: a sociocultural perspective. *Educ. Linguist.* 3, 169–170.

van Rensburg, J. E. S. (2018). Effective online teaching and learning practices for undergraduate health sciences students: an integrative review. *Int. J. Afr. Nurs. Sci.* 9, 73–80. doi: 10.1016/j.ijans.2018.08.004

Vandercruysse, S., Vandewaetere, M., Cornillie, F., and Clarebout, G. (2013). Competition and students' perceptions in a game-based language learning environment. *Educ. Technol. Res. Dev.* 61, 927–950. doi: 10.1007/s11423-013-9314-5

Wang, J.-L., Jackson, L. A., Gaskin, J., and Wang, H.-Z. (2014). The effects of Social Networking Site (SNS) use on college students' friendship and well-being. *Comput. Hum. Behav.* 37, 229–236. doi: 10.1016/j.chb.2014.04.051

Yoon, J. S., and Kerber, K. (2003). Bullying: elementary teachers' attitudes and intervention strategies. *Res. Educ.* 69, 27–35.

APPENDIX

TABLE 1 | Overarching themes and coding instructions.

Corresponding dimension of the CHAT framework	Sub-theme and coding instructions	Sample of coded text
Mediating artifacts	Technical facility and Internet connection	I think burnout depends on each individual. For me, it is not really severe but for those who cannot afford this mode in terms of technical facilities, it is very difficult. My phone screen was too small and I was very depressed when I had to read a lot of information on the teacher slides.
	Learning management system and course materials	I was burnout after spending the whole day in front of the computer studying. I did not think any exercises on the LMS were necessary. I was just indifferent toward all the activities there.
Rules and regulations	Attendance checking and privacy concerns	Students achieve less when doing exercise on the LMS in comparison to doing more meaningful exercises with friends in the face-to-face class.
	Online behavior, etiquette, and cyber-bullying	We did not achieve anything in an online class besides humiliation and embarrassment.
	Online exam regulations	The test failed to measure correctly how hard-working each student was.
Division of labor	Teacher roles	When nobody replied to the teacher, she started to feel stressed. And then the whole lesson started to be stressful because both the teacher and the students did not care about what each other was doing anymore.
	Institutional roles	Except for the delivery of the course, I did not notice any support from the school. There were just some Facebook posts to encourage us. That's all.
Community	Quarantine zone community	People there tried their best not to disturb me.
	Family and roommates	While studying at home, I cannot stay in the same place and concentrate as I did in class. I was interrupted by people around.
	Online social networking communities	The funny English memes that the schools share online really helped the students to burst out laughing. They were like an emotional recharge.

![frontiers | Frontiers in Education]

Check for updates

Optimizing Education Processes During the COVID-19 Pandemic Using the Technology Acceptance Model

Martinus Tukiran*, Widodo Sunaryo, Dian Wulandari and Herfina

Department of Education Management, Post Graduate School, Pakuan University, Bogor, Indonesia

The COVID-19 epidemic has become a significant global obstacle as it has impacted people's lives in various sectors, including social, economic, and education. To respond to the shock caused to education systems, massive efforts—such as conducting formal education through online classes—have been made. This study has employed Structural Equation Modeling (SEM) to examine this arena during the COVID-19 pandemic and has elaborated on how effectively the education system responded, especially through online lecturing. The Technology Acceptance Model (TAM) was implemented as this study's theoretical framework. Partial Least Squares Structural Equation Modeling was employed to measure and assess the proposed model. This study was conducted through a survey with 112 student participants in a postgraduate program between January and December 2021. The findings showed that (1) the TAM-based proposed variables have been successfully explained during the pandemic through factors predicting the use by an online class of postgraduate students, (2) significant effects were reported from perceived ease of use and perceived usefulness toward actual system use through behavioral intentions to use, (3) there were no significant results to show an indirect effect from perceived ease of use and perceived usefulness toward actual system use through behavioral intentions to use.

Keywords: COVID-19 pandemic, e-learning, technology acceptance model, education technology, education process

INTRODUCTION

The WHO declared the COVID-19 outbreak to be a pandemic on March 11, 2020. COVID-19 is a monumental problem affecting more than 200 countries, including Indonesia (WHO, 2021), which has been exposed to the COVID-19 virus since it was first detected on March 2, 2020. COVID-19 has also interrupted the education process, affecting approximately 1.6 billion students from more than 190 countries. To date, nearly 178 million cases have been detected (WHO, 2021). Ensuring learning continuity while schools are closed has become a priority for governments worldwide. Many education authorities are adopting Information and Communication Technology (ICT) and asking teachers to switch to online education. However, there is no clear evidence that school closures have been effective in controlling the spread of the virus (Isfeld-Kiely and Moghadas, 2014). While online learning in higher education is usually implemented through recorded lectures and online platforms, some universities have been warned that both students

and faculty members lack IT infrastructure. Some programs have been successfully implemented online, while others have not, leaving questions about the harmony between semesters and academic calendars [United Nations (UN), 2020]. Since there is a definite need to use cognitive process technology during the pandemic, several studies have addressed this issue (Almanthari et al., 2020; Kerres, 2020). Specifically, this technology is an online virtual classroom application that leverages the communication process during classroom activities. The use of e-learning in higher education is generally detailed in terms of affordable cost and learning effectiveness (Clark and Mayer, 2016). Under normal circumstances, e-learning can support face-to-face learning as a complementary tool. Several studies on the effectiveness of e-learning have been published (Shi et al., 2020). However, COVID-19 has necessitated the immediate implementation of e-learning, and several studies on e-learning applications in education have been published (Abbasi et al., 2020; Almanthari et al., 2020; Favale et al., 2020; Radha et al., 2020). However, research on the implications of e-learning use is still scarce. Therefore, this study aimed to understand the predictors of e-learning effectiveness, especially the use of online classroom learning, through pathway analysis of doctoral students in Indonesia. It adopted the Technology Acceptance Model (TAM) as an academic model for understanding the relationship between extrinsic and intrinsic components.

E-learning, especially online learning, entails students being physically separated from their teachers and requiring technology as a delivery method (Wilde and Hsu, 2019). Interactions between students and faculty using technology can affect learning outcomes (Bower, 2019; Gonzalez et al., 2020). Online education and effective online education outcomes from well-prepared instructional design and planning have been studied for many years (Hodges et al., 2020). However, the COVID-19 pandemic required students around the world to switch from face-to-face classes to an online learning environment in the middle of the semester, although there is no clear evidence of the effectiveness of school closures in reducing the spread of the virus (Isfeld-Kiely and Moghadas, 2014). Human beings have limited information processing capabilities; hence, learning modality combinations can lead to cognitive overload, and impair the ability to master new information. If students are inexperienced with technology and lack a sense of cognitive involvement and social connectivity, learning outcomes may be adversely affected (Bower, 2019). By contrast, the effective use of technology can allow students and faculty members to engage and collaborate with each other (Gonzalez et al., 2020). Studies on users' intent have examined how students influence the success of online learning and the usefulness of technology (Kemp et al., 2019; Yakubu and Dasuki, 2019). Another study reported that the effectiveness of online learning depends on the level of user acceptance (Tarhini et al., 2016). Therefore, it is crucial to analyze factors related to the use and adoption of technology, which is one of the aims of this study. The TAM was developed by Fred Davis and Richard Bagozzi (Davis, 1989; Bagozzi, 2007) and is one of the most widely used models to examine user acceptance and technology use (Venkatesh, 2000; Kemp et al., 2019). The first TAM was

based on a cognitive theory that described the process of adopting behaviors, and this model relates to users' willingness to use, and their continued use of, technology (García Botero et al., 2018; Teran-Guerrero, 2019).

During the COVID-19 pandemic, universities and their faculties were unable to appropriately plan and design their online learning lessons. Further, the social distancing necessitated by COVID-19 created a new social reality, which is the subject of this study.

METHOD

Numerous science education frameworks have been used to understand the integration of technologies, especially the use of e-learning and online learning. Within this framework, the TAM is the most widely used and reported model in the social sciences context (Teo et al., 2018). The TAM defines this setting and predicts people's positive or negative emotions about behavioral intent performance associated with system adoption by the perceived usefulness and perceived ease of use of the system (Davis, 1989). In the original TAM theory, the model comprises perceived ease of use and perceived usefulness. In addition, it adapts behavioral intent (the extent to which people perform or do not perform certain future actions) to the system, predicting attitudes and perceived utility. Finally, the actual usage, called system usage, is predicted by behavioral intent (Davis, 1989). Studies have reported several external factors associated with the original TAM structure (Venkatesh and Davis, 2000; Venkatesh and Bala, 2008). Specifically, the TAM has been enhanced through a report on the integration of e-learning in education

TABLE 1 | The framework of the technology acceptance model.

Constructs	Indicators	Sources
Actual use system (ASU)	➢ Consistency Usage ➢ Transparency Usage ➢ Suitability of Procedure ➢ Satisfaction Usage	➢ Davis, 1989
Perceived usefulness (PU)	➢ Responding to the needs of purposes ➢ Control over the job ➢ Importance of the job ➢ Improvisation jobs ➢ Improved user performance	➢ Davis, 1989 ➢ Venkatesh, 2000
Perceived ease of use (PEU)	➢ Easy to learn ➢ Easy to remember ➢ Easy to understand Availability of usage instructions	➢ Venkatesh, 2000 ➢ Davis, 1989
Behavioral intention to use (BIU)	➢ Motivation for permanent use ➢ Willingness to use in the future ➢ Experiences ➢ Motivation for usage ➢ Motivating others	➢ Davis, 1989

FIGURE 1 | Theoretical framework.
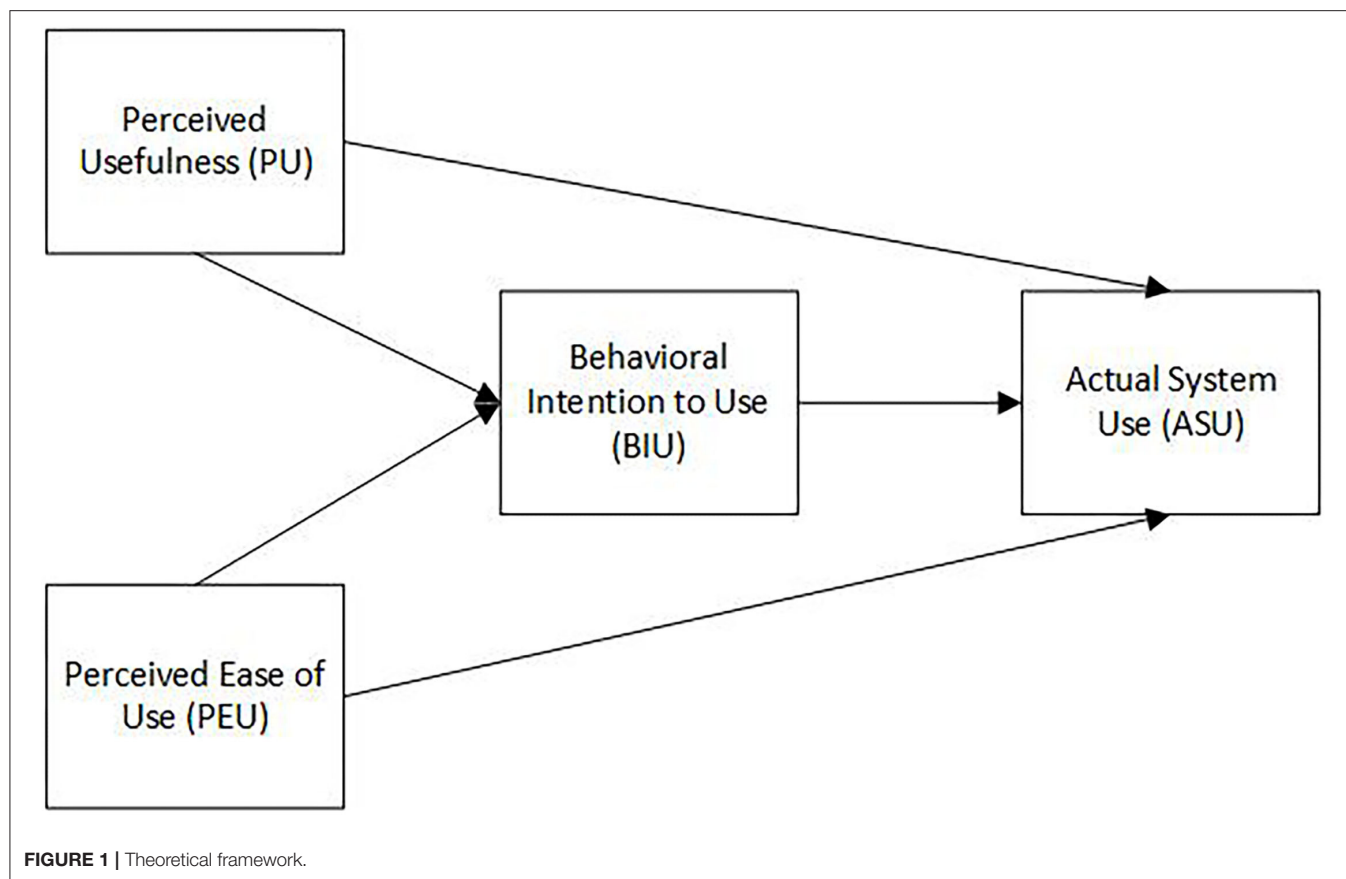
(Cakir and Solak, 2015; Mohammadi, 2015; Ramírez-Correa et al., 2019). For the purposes of this study, based on the original TAM, a hypothetical factor for predicting actual usage systems in terms of perceived ease of use, perceived usefulness, and behavioral intent to use is proposed. **Table 1** depicts the TAM's framework.

This study uses quantitative data methods aimed at analyzing the usefulness, ease of use, behavioral uses, and actual use systems of online courses in Indonesian graduate education during the COVID-19 pandemic. The data were collected from January 2021 until December 2021. The sample selection method uses purposive sampling, which is based on the willingness of members to participate and respond to questionnaires shared via Google forms. The target population comprised 112 students in graduate programs. The structural equation model (SEM) was used to analyze multiple regression, as well as path analysis diagrams to visualize what was happening. All the variables integrated into the questionnaire were obtained from a previous literature search. In addition, all the questions were discussed with a panel of scholars and industry experts to assess the questionnaire items' validity. Throughout the questionnaire, a 5-point Likert Attitude Scale (1—totally disagree; 5—completely agree) and a behavioral rating scale (1- never; 5 -always) were used.

The relationship among constructs is depicted in a theoretical framework (**Figure 1**). The actual use system, as an endogenous construct, is measured with the following indicators: consistent usage (asu1, asu2, asu3, and asu4), transparency usage (asu5, asu6, asu7, and asu8), suitability of procedure (asu9, asu10, asu11, and asu12), and satisfaction usage (asu13, asu14, and asu15) adapted from the work of Davis (1989). The reason for adapting instruments that have been used by Davis (1989) and Venkatesh (2000) is that it links this study to all other research studies that have used the same instrument.

Conversely, the exogenous variable of perceived usefulness is measured through the following: responding to the needs of purposes (pu1, pu2, and pu3), control over the job (pu4, pu5, and pu6), the importance of the job (pu7, pu8, and pu9), job improvisation (pu10, pu11, and pu12), and improved user performance (pu13, pu14, and pu15), which were adapted from the work of Davis (1989) and Venkatesh (2000).

Perceived ease of use is measured through easy to learn (peu1, peu2, peu3, and peu4), easy to remember (peu5, peu6, peu7, and peu8), easy to understand (peu9, peu10, peu11, and peu12), and the availability of usage instructions (peu13, peu14, and peu15), which were adapted from the work of Davis (1989) and Venkatesh (2000).

Behavioral intentions to use were measured with motivation for permanent usage (biu1, biu2, and biu3), willingness to use

FIGURE 2 | Convergent validity testing.
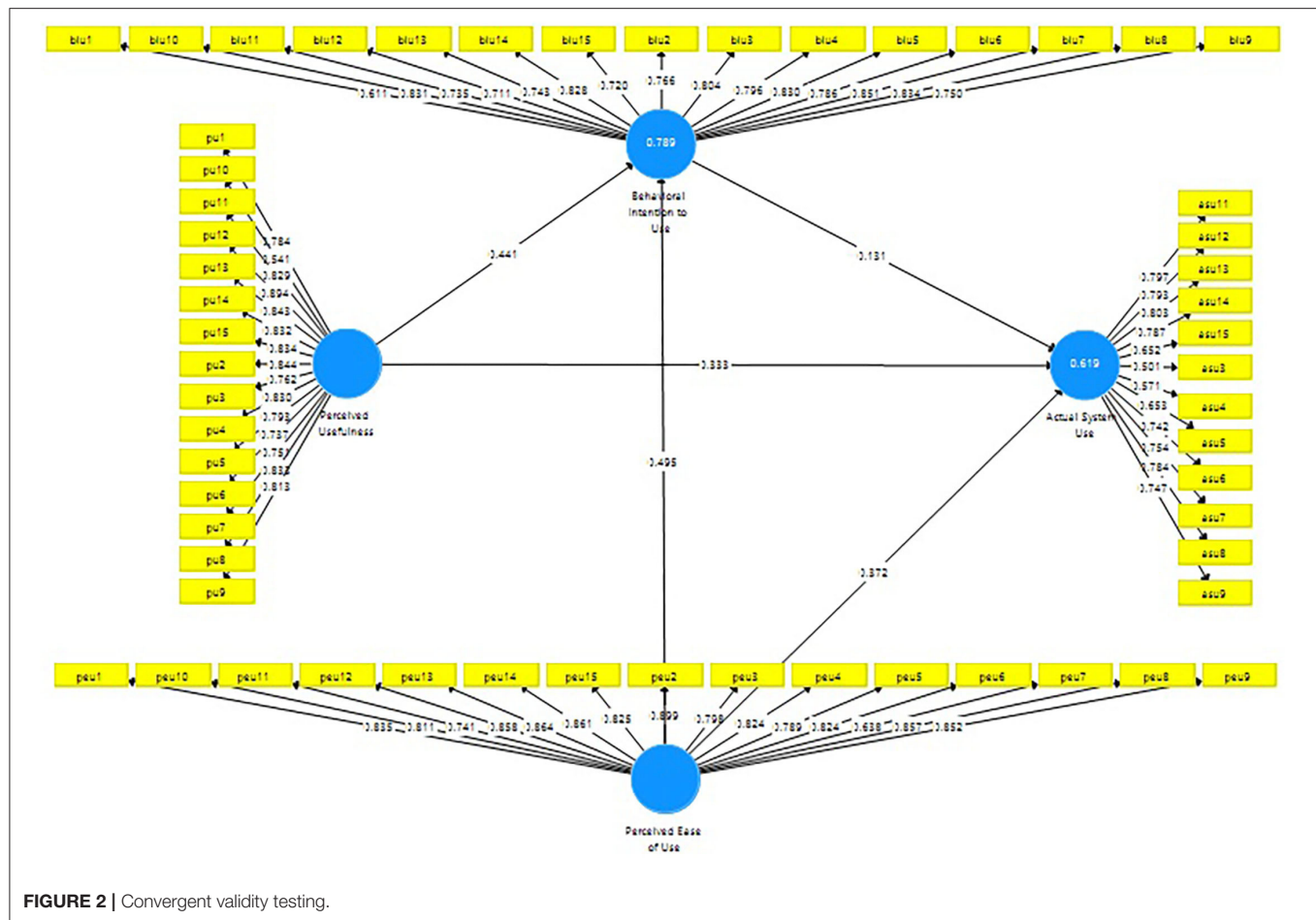
in the future (biu4, biu5, and biu6), experiences (biu7, biu8, and biu9), motivation for usage (biu10, biu11, and biu12), motivating others (biu13, biu14, and biu15), that were developed from the work of Davis (1989).

Based on the parameters, the following hypotheses will be tested:

1. Perceived usefulness positively affects actual system use.
2. Perceived ease of use positively affects actual system use.
3. Behavioral intention to use positively affects actual system use.
4. Perceived usefulness positively affects behavioral intention to use.
5. Perceived ease of use positively affects behavioral intention to use.
6. Perceived usefulness positively affects actual system use through behavioral intention to use.
7. Perceived ease of use positively affects actual system use through behavioral intentions to use.

The testing phase of the measurement model included testing for convergent and discriminant validity and combined reliability. The results of partial least squares (PLS) analysis can be used to test research hypotheses, if all indicators of the PLS model pass the requirements of convergent and discriminant validities,

and reliability checking. Convergence validation was performed by comparing the load factor value of each indicator with its components (**Figure 2**). Weights of factors greater than or equal to 0.5 are considered well-validated to explain the latent structure (Hair et al., 2020). In this study, if the average variance extracted (AVE) value was >0.5 for each configuration, the minimum allowable load factor limit was 0.5.

Based on the PLS model estimation results in **Figure 2**, given that the load factor values for all indicators exceeded 0.5, the model met the convergence validity requirement. In addition to checking the load factor values for each indicator, the validity of convergence was also evaluated using the AVE values for each configuration. Since each configuration's AVE was over 0.5, the convergent validity of this study's model met the requirements. The charge value, Cronbach's alpha, composite reliability, and AVE for each complete configuration are shown in **Table 2**.

The reliability of a construct can be assessed using the Cronbach's alpha score and the combined reliability of each construct. The recommended association reliability and Cronbach's alpha values are over 0.7, as shown in the reliability test results in **Table 2**, wherein all configurations have compound reliability and Cronbach's alpha values >0.7 (>0.7). In summary, all configurations met the required reliability values.

TABLE 2 | Cronbach's alpha, composite reliability, and average variance extracted (AVE).

	Cronbach's alpha	Rho_A	Composite reliability	Average variance extracted (AVE)
Actual system use	0.914	0.924	0.928	0.521
Behavioral intention to use	0.952	0.955	0.957	0.602
Perceived ease of use	0.965	0.967	0.968	0.673
Perceived usefulness	0.958	0.962	0.963	0.638

TABLE 3 | Respondents' profile.

	N	%
Gender		
Male	73	65
Female	39	35
Total	112	100
Ages		
50 above	20	18
40–49	32	29
30–39	49	44
<30	11	9
Total	112	100
Academic level		
Master's degree students	65	58
Doctoral degree students	47	42
Total	112	100

TABLE 4 | R squared.

	R squared	R squared adjusted
Actual system use	0.619	0.609
Behavioral intention to use	0.789	0.785

RESULTS

Respondents' demographic profiles related to gender, age, and academic level are presented in **Table 3**. Most of the respondents were male (65%), with the majority (44%) of respondents were in between 30 and 39 years old. Further, most of the respondents (58%) are master's degree students compared to (42%) who are doctoral degree students.

The validity and reliability test includes a significance test for direct and indirect effects and a measure of the magnitude of the effect of the exogenous variables on the endogenous variable. Impact testing was performed using statistical testing of a PLS analytical model using SmartPLS 3.3 software. The bootstrapping technique is used to obtain the R Square value and the significance test values, as shown in **Table 4**.

Table 4 also shows that the actual system usage R^2 value is.619. This shows that the organizational variable is 61.9% for actual system usage. This is explained by the perceived usefulness and ease of use, and behavioral intent to use. The remaining 38.1% was explained by other variables not discussed in this study.

Similarly, the coefficient of determination for behavioral intent is 0.789, implying that 78.9% of the behavioral intent variable is explained by the perception of usefulness and ease of use, and the remaining 21.1% by other variables that have not been discussed in this study. **Table 5** shows the results of hypotheses testing for all the variables having a direct impact.

DISCUSSION

This study confirms that during COVID-19, students need to immediately switch from a face-to-face to an online learning environment and use virtual classroom applications for the implementation of the educational process, as the results of several studies on the application of e-learning in education have been published (Abbasi et al., 2020; Almanthari et al., 2020; Favale et al., 2020; Radha et al., 2020).

The proposed TAM-based variables are well described as predictors of the evolution of online graduate classes during the pandemic. However, the intended use of behavior does not significantly affect the use of the system (Hypothesis 3, 6, and 7 through Behavioral Intention show that the hypothesis is not proven).

Although the use of e-learning has succeeded in encouraging the implementation of the educational process through virtual classrooms, this study has shown that the use of e-learning alone on an ongoing basis is undesirable. It should be remembered that student intentions will affect learning outcomes (Tarhini et al., 2016; Kemp et al., 2019; Yakubu and Dasuki, 2019).

The public, including students in the education process, is tired of dealing with COVID-19. However, the end of physical restrictions is still not in sight, given that the COVID-19 mutant has brought about the next wave of the pandemic. In the educational process, students must learn physically apart from the teacher and class (Wilde and Hsu, 2019). Due to the unpredictable ending, several countries have decided that COVID-19 should be treated as endemic, where humans must live and survive in the new situation.

This study shows that although the perceived usefulness and ease of use variables directly show a significant effect, the indirect effect through behavioral intentions for the actual use of the system shows insignificant results. This can be interpreted that although students have experienced the convenience and benefits of virtual classroom application technology, they do not consider it desirable or show interest in maintaining this situation in the future. This shows that a long online learning process affects the learning process and outcomes (Bower, 2019; Gonzalez et al., 2020).

Thus, we can conclude that face-to-face learning is an irreplaceable educational process, and technology is a complement rather than a major factor in the educational process.

Based on this context, education is a process of interaction between humans through a series of instruments that facilitate the educational process to run more effectively and efficiently (Megahed and Mohammed, 2020; Shi et al., 2020). Technology is one of the instruments that can improve the educational

TABLE 5 | The structural equation modeling results.

	Original sample (O)	Sample mean (M)	Standard deviation (STDEV)	T statistics (|O/STDEV|)	P values	Conclusion
Behavioral intention use -> Actual system use	0.131	0.133	0.097	1.348	0.178	Not significant
Perceived ease of use -> Actual system use	0.372	0.383	0.128	2.904	0.004	Significant
Perceived ease of use -> Behavioral intention use	0.495	0.494	0.071	7.016	0.000	Significant
Perceived usefulness -> Actual system use	0.333	0.326	0.125	2.653	0.008	Significant
Perceived usefulness -> Behavioral intention use	0.441	0.443	0.072	6.098	0.000	Significant
Perceived ease of use -> Actual system use, through behavioral intention use	0.065	0.065	0.049	1.311	0.191	Not significant
Perceived usefulness -> Actual system use, through behavioral intention use	0.058	0.059	0.045	1.276	0.276	Not Significant

process. However, technology cannot replace the role of lecturers in the classroom.

Technology Acceptance Model has been used everywhere to analyze the effectiveness of information technology, including in education. Many studies on TAM have demonstrated its success in defining people's attitudes, and positive or negative feelings about behavior toward adopting a system, which is predicted by perceived usefulness and ease of use.

The current results suggest that several variables in TAM, such as perceived usefulness and ease of use, directly influence behavioral intentions to use, including actual system use. However, the indirect effect did not show significant results. This is presumably because information technology is a complementary factor in the educational process and is not the main factor. Furthermore, the role of lecturers in direct interaction with students is suspected to be an irreplaceable factor in the educational process. This assumption requires further research to show that direct interaction between lecturers and students is human-human interaction which is an important part of the educational process.

Since this research was conducted in higher education institutions, especially in postgraduate programs, this article does not aim to generalize but rather to identify and develop preliminary discussions related to theoretical elements. This is undoubtedly the main limitation of this article. Future research on investigating the effectiveness of information technology use in the educational process should capture the importance of this underlying tension.

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

ETHICS STATEMENT

Ethical review and approval was not required for the study on human participants in accordance with the local legislation and institutional requirements. The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

ACKNOWLEDGMENTS

REFERENCES

Abbasi, S., Ayoob, T., Malik, A., and Memon, S. I. (2020). Perceptions of students regarding E-learning during Covid-19 at a private medical college. *Pak. J. Med. Sci.* 36, 5. doi: 10.12669/pjms.36.COVID19-S4.2766

Almanthari, A., Maulina, S., and Bruce, S. (2020). Secondary school mathematics teachers' views on E-learning implementation barriers during the COVID-19 pandemic: the case of Indonesia. *Eurasia J. Math. Sci. Technol. Educ.* 16, em186. doi: 10.29333/ejmste/8240

Bagozzi, R. P. (2007). The legacy of the technology acceptance model and a proposal for a paradigm shift. *J. Assoc. Inf. Sys.* 8 244–254. doi: 10.17705/1jais.00122

Bower, M. (2019). Technology-mediated learning theory. *Br. J. Educ. Technol.* 50, 1035–1048. doi: 10.1111/bjet.12771

Cakir, R., and Solak, E. (2015). Attitude of Turkish EFL learners towards e-learning through tam Model. *Proc. Soc. Behav. Sci.* 176, 596–601. doi: 10.1016/j.sbspro.2015.01.515

Clark, R. C., and Mayer, R. E. (2016). *E-learning and the Science of Instruction: Proven Guidelines for Consumers and Designers of Multimedia Learning.* New Jersey: John Wiley and Sons. p. 292–311.

Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Q.* 13, 319–340. doi: 10.2307/249008

Favale, T., Soro, F., Trevisan, M., Drago, I., and Mellia, M. (2020). Campus traffic and e-learning during COVID-19 Pandemic. *Comput. Netw.* 176, 107290. doi: 10.1016/j.comnet.2020.107290

García Botero, G., Questier, F., Cincinnato, S., He, T., and Zhu, C. (2018). Acceptance and usage of mobile assisted language learning by higher education students. *J. Comput. High. Educ.* 30, 426–451. doi: 10.1007/s12528-018-9177-1

Gonzalez, T., de la Rubia, M., Hincz, K., Lopez, M. C., Subirats, L., Fort, S., et al. (2020). Influence of COVID-19 confinement in students' performance in higher education. *Jama* 20, 90. doi: 10.1371/journal.pone.0239490

Hair, J. F., Howard, M. C., and Nitzl, C. (2020). Assessing measurement model quality in PLS-SEM using confirmatory composite analysis. *J. Bus. Res.* 109, 101–110. doi: 10.1016/j.jbusres.2019.11.069

Hodges, C., Moore, S., Lockee, B., Trust, T., and Bond, A. (2020). *The difference between emergency remote teaching and online learning. EDUCAUSE Review.* Available online at: https://er.educause.edu/articles/2020/3/the-difference-between-emergency-remote-teaching and-online-learning

Isfeld-Kiely, H., and Moghadas, S. (2014). *Effectiveness of School Closure for the Control of Influenza.* National Collaborating Centre for Infectious Diseases. Available online at: https://nccid.ca/publications/effectiveness-of-school-closure-for-the-control-of-influenza/ (accessed August 24, 2021).

Kemp, A., Palmer, E., and Strelan, P. (2019). A taxonomy of factors affecting attitudes towards educational technologies for use with technology acceptance models. *Br. J. Educ. Technol.* 50, 2394–2413. doi: 10.1111/bjet.12833

Kerres, M. (2020). Against all odds: education in Germany coping with Covid-19. *Postdigit. Sci. Edu.* 20, 690–694. doi: 10.1007/s42438-020-00130-7

Mohammadi, H. (2015). Investigating users' perspectives on e-learning: an integration of TAM and IS success model. *Comput. Hum. Behav.* 45, 359–374. doi: 10.1016/j.chb.2014.07.044

Radha, R., Mahalakshmi, K., Kumar, V. S., and Saravanakumar, A. R. (2020). E-Learning during lockdown of covid-19 pandemic: a global perspective. *Int. J. Control Autom.* 13, 1088–1099. Available online at: http://sersc.org/journals/index.php/IJCA/article/view/26035

Ramírez-Correa, P. E., Arenas-Gaitán, J., and Rondán-Cataluña, F. J. (2019). Gender and acceptance of e-learning: a multi-group analysis based on a structural equation model among college students in Chile and Spain. *PloS One* 10, e0140460. doi: 10.1371/journal.pone.0140460

Shi, D., Wang, T., Xing, H., and Xu, H. (2020). A learning path recommendation model based on a multidimensional knowledge graph framework for e-learning. *Knowl. Base Syst.* 195, 105618. doi: 10.1016/j.knosys.2020.105618

Tarhini, A., Hone, K., Liu, X., and Tarhini, T. (2016). Examining the moderating effect of individual-level cultural values on users' acceptance of E-learning in developing countries: a structural equation modeling of an extended technology acceptance model. *Interact. Learn. Environ.* 3, 306–328, doi: 10.1080/10494820.2015.1122635

Teo, T., Sang, G., Mei, B., and Hoi, C. K. W. (2018). Investigating pre-service teachers' acceptance of Web 2.0 technologies in their future teaching: a Chinese perspective. *Interact. Learn. Environ.* 27, 1–17. doi: 10.1080/10494820.2018.1489290

Teran-Guerrero, F. N. (2019). Aceptación de los estudiantes universitarios en el uso de los sistemas e-learning Moodle desde la perspectiva del modelo TAM.//Acceptance of university students in the use of Moodle e-learning systems from the perspective of the TAM model. *Revista Ciencia UNEMI.* 12, 63–76. doi: 10.29076/issn.2528-7737vol12iss29.2019pp63-76p

United Nations (UN) (2020). *Policy Brief: Education During Covid-19 and Beyond.* New York, NY: UN, Available online at: https://www.un.org/development/desa/dspd/wp-content/uploads/sites/22/2020/08/sg_policy_brief_covid-19_and_education_august_2020.pdf.

Venkatesh, V. (2000). Determinants of perceived ease of use: integrating control, intrinsic motivation, and emotion into the technology acceptance model. *Inf. Sys. Res.* 11, 342–365. doi: 10.1287/isre.11.4.342.11872

Venkatesh, V., and Bala, H. (2008). Technology acceptance model 3 and a research agenda on interventions. *Decis. Sci.* 39, 273–315, doi: 10.1111/j.1540-5915.2008.00192.x

Venkatesh, V., and Davis, F. D. (2000). A theoretical extension of the technology acceptance model: four longitudinal field studies. *Manage. Sci.* 46, 186–204. doi: 10.1287/mnsc.46.2.186.11926

WHO (2021). *WHO Coronavirus Disease (COVID-19) Dashboard.* Available online at: https://covid19.who.int/ (accessed June 28, 2021).

Wilde, N., and Hsu, A. (2019). The influence of general self-efficacy on the interpretation of vicarious experience information within online learning. *Int. J. Educ. Technol. High. Educ.* 16, 1–20. doi: 10.1186/s41239-019-0158-x

Yakubu, M. N., and Dasuki, S. I. (2019). Factors affecting the adoption of e-learning technologies among higher education students in Nigeria: a structural equation modeling approach. *Inf. Dev.* 35, 492–502. doi: 10.1177/0266666918765907

frontiers | Frontiers in Education

Hybrid Teaching: Conceptualization Through Practice for the Post COVID-19 Pandemic Education

Mark Bedoya Ulla[1] and William Franco Perales[2]*

[1] Saint Louis University, Baguio City, Philippines, [2] Walailak University, Thai Buri, Thailand

While a number of studies have previously conceptualized hybrid teaching, often used interchangeably with blended learning during the pre-COVID-19 pandemic, hybrid teaching has been undertheorized and unexplored during and post-COVID-19 pandemic when schools have slowly opened their classrooms for students. This paper explores the concept of hybrid teaching (also referred to as hybrid classroom instruction and hybrid learning) and how such teaching methodology is different from blended learning, fully online, and remote teaching by presenting a teacher's practice during the COVID-19 pandemic. Although our goal is to identify clearly what hybrid teaching is, we do not intend to offer a definite conceptualization and practice of hybrid teaching as teaching is context-dependent. However, we argue that hybrid teaching has the potential to be one of the teaching methodologies in the post COVID-19 pandemic education, especially when schools and universities are in the transition back to residential classroom teaching.

Keywords: education, hybrid classroom, hybrid teaching, online teaching & learning, post COVID-19 pandemic

INTRODUCTION

The COVID-19 pandemic has undoubtedly changed the educational landscape in all schools and universities in the world as these schools migrated to online and remote teaching from residential classroom teaching. Studies have reported that while migrating to online teaching, teachers faced issues that challenged their classroom pedagogical practices, doubted their teaching abilities, and questioned the learning outcomes of their students (Ulla and Achivar, 2021; Ulla and Perales, 2021a; Maatuk et al., 2022). Teachers were not prepared to migrate to online and remote teaching, given the lack of training, experience, and orientation in conducting online classes (Chakraborty et al., 2021; Ulla and Perales, 2021b). In addition, migrating to online teaching during the COVID-19 pandemic was sudden. Teachers may not have time to redesign their teaching materials, assessments, and other learning resources that contributed to their encountered issues. Other schools may not have a well-designed learning management system (LMS), internet connectivity, and electronic gadgets that teachers and students could utilize during this unprecedented time (Nhu et al., 2019; Ulla and Perales, 2021b).

However, despite these challenges, the COVID-19 pandemic has also caught the interest of some education scholars, practitioners, and researchers in innovating the traditional classroom teaching practice to suit the current educational context. Studies have shown the significance of online teaching and learning resources, the provision of electronic devices, online platforms, and various online applications to make online and remote teaching possible and successful.

The asynchronous and the synchronous teaching have also become the most crucial teaching modalities, offering choices for teachers and students to continue the teaching and learning process (Moorhouse and Wong, 2022). For instance, teachers utilize popular online platforms such as Zoom, Microsoft Teams, and Google Meet as their virtual classrooms where they synchronously meet their students (Kansal et al., 2021). Some teachers may have employed an asynchronous teaching modality where they used online platforms like Facebook, Moodle, and Google classroom for students who may have an intermittent internet connection. In addition, teaching materials have also been modified for online teaching, and teachers employed online applications such as Kahoot, Socrative, Quizlet, and Quizizz to make their online teaching interactive and fun (Sayıner and Ergönül, 2021). In other words, despite the pedagogical challenges that teachers faced in their online teaching, it may be noted that teachers may also have learned from this experience where they became more resourceful, flexible, and creative teachers who were willing to adapt to the changing landscape of education.

With the current situation in education, uncertainties are the only certain, especially since no one knows when this pandemic will end. Neuwirth et al. (2021) mentioned that teaching and education "will not be a return to normal, but rather that it will be a new normal, which will be quite different from anything that we have known before" (p. 143). This suggests that transitioning back to residential classroom teaching may also be challenging, considering parents' and their students' doubts about whether they are safe or not to go back to the campus. In other words, although some universities have slowly opened their classrooms back for their students, other parents and their students may not be comfortable and confident just yet to go back to the residential classroom learning. Thus, schools, especially in some higher education institutions (HEIs), may offer a hybrid classroom where teachers and students meet for hybrid teaching and learning. However, although hybrid teaching may not be a new teaching method in education, studies in the literature gave no definite conceptualization and theorization of the concept, as it is often used to refer to blended learning. Such unclear distinction only leaves classroom teachers puzzled about its use, purpose, and meaning, especially during this COVID-19 pandemic, when all education institutions may still have no clear guidelines regarding the return to face-to-face classroom instruction.

This article discusses the concept of hybrid teaching in a hybrid classroom by examining relevant studies exploring this concept in the pre and during the COVID-19 pandemic and how hybrid teaching is conducted by presenting a teacher's teaching practice in a university in Thailand. However, our goal is not to give a definite conceptualization of hybrid teaching and teaching practice. We want to contribute to hybrid teaching practice and its theorization through this article based on our teaching context. Thus, this article hopes to shed light on the nuances of the features and practices of hybrid teaching so that education practitioners, scholars, and policymakers will have something to consider when deciding to do hybrid teaching in post COVID-19 education.

DEFINING HYBRID TEACHING

Studies in the literature present no clear definition of hybrid teaching, its differences from other modes of lesson delivery (e.g., blended learning), and how such teaching methodology is conducted in the teaching and learning environment, especially during the COVID-19 pandemic. In fact, these studies used the concept of hybrid teaching or learning interchangeably with blended learning (O'Byrne and Pytash, 2015; see Klimova and Kacetl, 2015; Solihati and Mulyono, 2017; Smith and Hill, 2019), emphasizing the combination of residential classroom instruction with computer-mediated instruction. For instance, Linder (2017) broadly defined hybrid teaching as a teaching method that integrates technology to provide students with a different learning environment while catering to their learning needs and preferences. Such a definition is similar to Garrison and Kanuka's (2004) definition of blended learning as "a thoughtful integration of classroom face-to-face learning experiences with online learning experiences" (p. 96). Garrison and Vaughan (2013) emphasized that in blended learning, "learning designs are informed by evidence-based practice and the organic needs of the specific context" (p. 24). This suggests that both hybrid teaching and blended learning primarily consider the needs of the teaching context and that instructional designs are geared toward students' learning experiences.

Consequently, Oliver and Trigwell (2005), Klimova and Kacetl (2015), and Smith and Hill (2019) acknowledged the complexity and ambiguity of the given definitions of hybrid teaching and blended learning. However, considering the various definitions of the concepts, it can be noted that hybrid teaching and blended learning are grounded on the following essential characteristics: the integration and the combination of the residential classroom teaching with online teaching and learning approaches (Oliver and Trigwell, 2005), the important role of technology in the teaching and learning process (Saichaie, 2020), and the use of class time for asynchronous and synchronous teaching and learning activities (Chen and Chiou, 2014; Linder, 2017; Solihati and Mulyono, 2017; Saichaie, 2020). Furthermore, Saichaie (2020) claimed that despite problematic distinction between these teaching and learning models, they "represent a departure from instructor-centered pedagogies (e.g., lecture) to student-centered pedagogies (e.g., active learning), where the focus is less on instructor delivery of content and more on student application of content (e.g., problem-solving)" (p. 96).

Although this paper aims not to distinguish and elevate one over the other, we defined hybrid teaching (also referred to as hybrid classroom instruction and hybrid learning) as an approach to teaching that not only integrates technology in the teaching process but also combines students who are inside a physical classroom and students from online. In other words, hybrid teaching is synchronous teaching of students in the classroom and online using an online platform, Zoom. Likewise, as a teaching methodology, it addresses students' learning preferences, especially during the COVID-19 pandemic, as students who were inoculated against the virus may choose whether to return to the classroom or continue learning online. Unlike in the fully online classroom, hybrid teaching allows

online students to join and engage in various learning discourses with their classmates in the physical classroom through Zoom (see **Figure 1**).

Moreover, hybrid teaching components are similar to residential classroom teaching and learning since they have the teacher and students' presence. Also, the lesson's design is based on the learning outcomes, and activities are aimed at students' learning (Linder, 2017). However, Saichaie (2020) noted that "class time" is more flexible in hybrid teaching, where one class period is substituted with online or offline activities for students' active learning. Most importantly, "hybrid courses have significant e-learning activities, including online quizzes and synchronous or asynchronous discussions, in addition to traditional classroom face-to-face teaching and learning (Vernadakis et al., 2011, p. 188).

HYBRID TEACHING DURING THE PRE-COVID-19 PANDEMIC

Although a number of empirical studies have explored hybrid teaching, its effectiveness compared to traditional classroom face-to-face teaching (Vernadakis et al., 2011; Chen and Chiou, 2014), teachers' experiences and perceptions (Drewelow, 2013; Solihati and Mulyono, 2017), and students' learning achievements and perceptions (Dowling et al., 2003; Lin, 2008), these mainly were conducted before the COVID-19 pandemic when electronic communication tools, CD-ROM, and TV were utilized for hybrid teaching, and the use of online conferencing platforms such as Zoom, Microsoft Teams, Google Meet, Facebook, and Google classroom was not yet popular. For example, Chen and Chiou (2014) investigated the impact of hybrid learning instruction on students' learning achievement, style, satisfaction, and classroom learning community compared to traditional classroom face-to-face teaching in a university in Taiwan. The teachers designed the hybrid curriculum, where the first eight weeks of instruction were devoted to teachers giving students a face-to-face lecture for both the study group and control group of students. In addition, the e-learning system was used for material posting, online discussion forums, and submission of assignments. In the tenth week, the study group received all the discussion for their final assignment in the e-learning system, while the control group had a face-to-face discussion for their final assignment. While the results revealed that students in the hybrid course had higher learning scores, satisfaction, and a stronger sense of community compared to traditional classroom face-to-face students, hybrid teaching was not implemented simultaneously with online and onsite students. Instead, both groups of students received the same instruction differently, one online and the other face-to-face.

Vernadakis et al. (2011) also conducted a similar study investigating the effectiveness of hybrid learning in delivering a computer science course compared to traditional lecture instruction in a university in Greece. Participants were one hundred seventy-two first-year university students randomly assigned to hybrid lecture instruction and traditional lecture instruction. The hybrid lecture instruction combined the

FIGURE 1 | The hybrid synchronous teaching flow.

FIGURE 2 | Teaching the hybrid classroom.
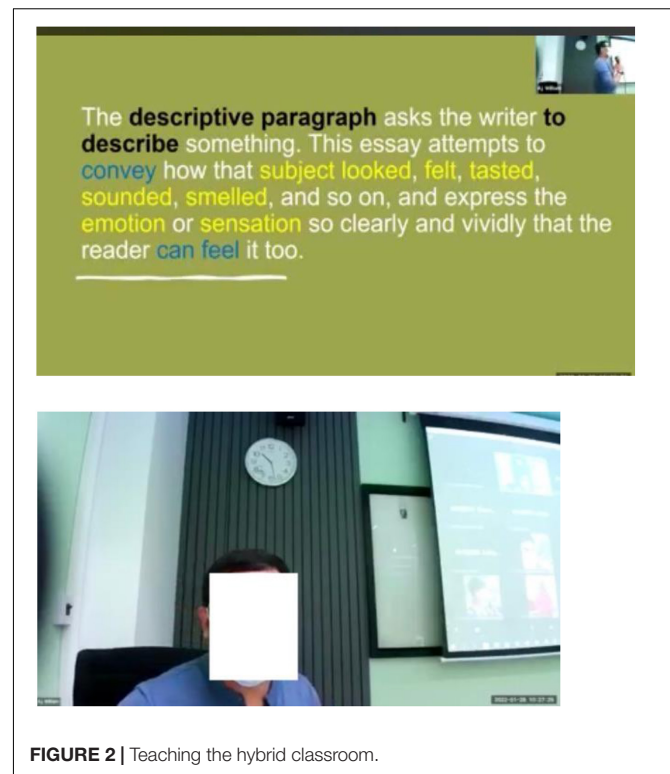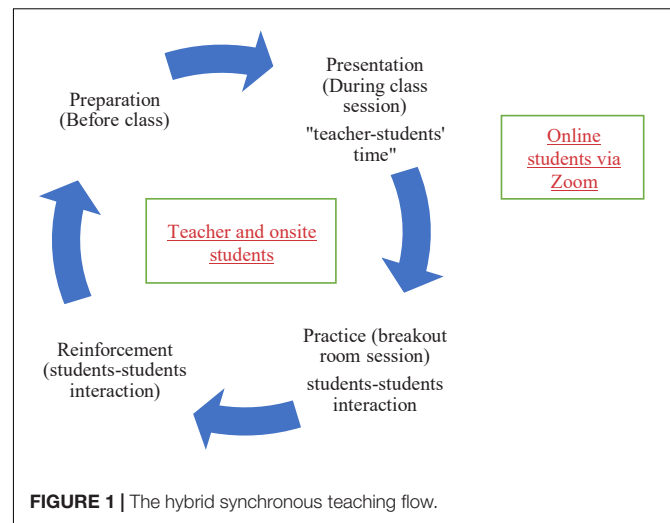
asynchronous learning activities on the internet and traditional learning activities in the classroom. Additionally, the hybrid lecture instruction was designed following a one-three ratio. Two lesson units were conducted using the traditional lecture instruction, and the remaining four units were conducted in a learning management system called the open eClass. Like the findings from the study by Chen and Chiou (2014), the results also pointed out that students in a hybrid lecture instruction had higher scores than those students in the traditional lecture instruction. Although Vernadakis et al. (2011) concluded that hybrid teaching instruction effectively facilitates
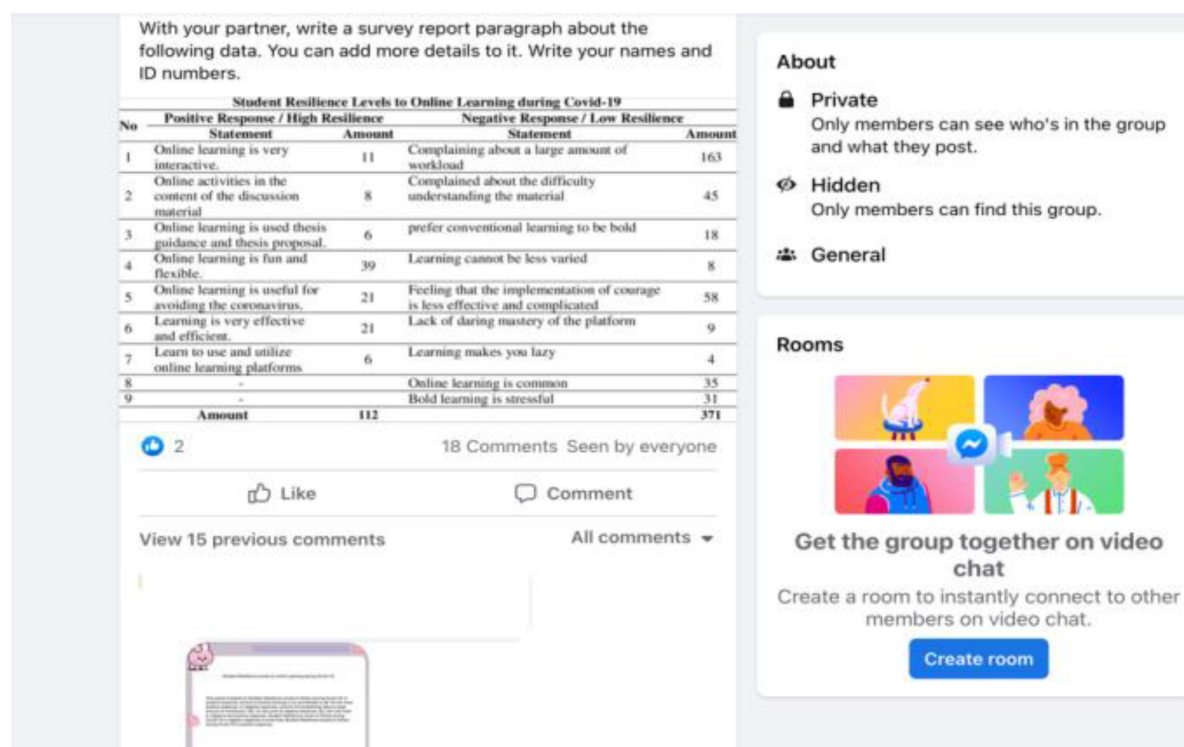
FIGURE 3 | An asynchronous sample activity on closed-class Facebook group.

students' understanding of planning and remembering factual and conceptual knowledge, it was not conducted simultaneously with students in the classroom and online. The technology integration was done only for asynchronous learning activities.

In Indonesia, Solihati and Mulyono (2017) employed a hybrid classroom instruction in an Indonesian private university and reflected on their experience as teachers of a hybrid classroom. They utilized the Google classroom as a site for their hybrid learning activities and conducted face-to-face instruction to students once a week for 100 min for 12 weeks. Similar to the studies by Chen and Chiou (2014) and Vernadakis et al. (2011), the asynchronous online activities in a hybrid instruction by Solihati and Mulyono were only done to support students' learning. In other words, hybrid teaching was not implemented in synchronous teaching, where students from onsite and online learned together. However, they recognized the benefits of hybrid teaching as it made the lesson delivery convenient and accessible for students.

Furthermore, positive perceptions regarding hybrid teaching were also common among 15 graduate teaching assistants in a public university in the United States. Drewelow (2013), who also examined teaching assistants' experiences in a hybrid teaching course, found that teaching assistants believed that a hybrid language class could facilitate student-centered instruction that is important for language acquisition. However, like the previous studies, the hybrid instruction was not implemented following the integration of an online platform where online and onsite students were connected simultaneously

for real-time instruction. Instead, as reported by Drewelow, the hybrid instruction also utilized the asynchronous online activities, where students were given 24 h to complete the tasks. Thus, the asynchronous online activities were only made to prepare students for face-to-face instruction, reinforce students' learning practices, and enhance their reading and writing skills.

Considering how classroom teachers implemented hybrid classroom instruction in different teaching and learning contexts, where there were no online and onsite students learning simultaneously, the present teaching practice adds to the discussion and practice of hybrid teaching, especially in the context of the COVID-19 pandemic. Likewise, this article provides a different perspective of how hybrid teaching was conducted in a university in Thailand and pushes forward one basic identifying feature of a hybrid classroom: the presence of students online and onsite. We maintain that a hybrid classroom is identified by utilizing an online platform where online students are connected to engage and participate in the learning discussion with their classmates and teacher in the onsite physical classroom.

HYBRID TEACHING: THE TEACHING PRACTICE

The Teaching Context

Hybrid teaching was conducted in a university in Thailand during the third term of 2020–2021 (January 2022–April 2022)

when the COVID-19 cases started to decline. Before the end of the second term, the university had announced the shift to hybrid teaching the following term for those students who were willing to come back to the campus. In other words, the university did not compel students to study back in the physical classroom but had given them an option whether to study onsite or online. Health safety protocols were followed (social distancing, vaccination, testing, wearing a mask, and sanitation) to ensure a successful transition to hybrid teaching. However, since there were still a number of students who were not confident to be back on the campus, there were still classes held online since most students preferred to study online.

The second author (the teacher) obtained a degree in English and currently finishing his Master of Arts degree in English language teaching. He has been teaching for almost 5 years already. Moreover, he conducted the hybrid teaching in one of his general English language classes (*English for Reading and Writing*) with 35 first-year students majoring in *Digital Communications*. Of these 35, only 12 students were onsite, and 23 were online. The class met once a week for 2 h every Friday from 10 to 12 noon.

The teacher acknowledged that he did not have experience and knowledge in conducting hybrid teaching. He also mentioned that there was no training that the university provided for the teachers on how to do hybrid teaching before the opening of the third semester. However, since this paper aims to present how a teacher perceives and conducts hybrid teaching in a university in Thailand, we believe that by presenting a teacher's hybrid teaching practice, we could contribute to the conceptualization of hybrid teaching, pushing forward some of the features of a hybrid classroom and highlighting the presence of students online and onsite. Our participant is ideal for the study since he does not know what a hybrid teaching is, and the university offers no training for them on how to conduct hybrid teaching. However, with his experience in conducting an online teaching and a residential classroom teaching and the provision of the technological equipment and platform in the classroom, he could use his pedagogical skills and knowledge to plan and design his hybrid classroom instruction.

THE TEACHING PRACTICE

Preparation

Before every class session, I had to prepare and create PowerPoint slides for my class. The contents of the slides were taken from our textbook. Sometimes, I had to look for other sources from the internet, especially video clips or listening audio. I also had to ensure that all my language activities worked in the online applications. For example, I used the Socrative application for my vocabulary activities, which was launched during the first 15 min of the class. I also used Google Forms for other language exercises. I needed to prepare all of these online applications before coming to my class so that my hybrid classroom instruction would run smoothly.

On the day of the class, I had to be in the classroom 15 min before the scheduled time to ensure that all technological equipment was ready and working for my hybrid class. I turned on the classroom air-conditioning, checked the computer, web camera, internet connection, and microphone, and turned on the multimedia projector. I also logged into my google drive, where all the class teaching materials were stored, including the class register, the lesson slides, and online links to my language activities. I then opened them all for easy access when the class started. I also logged into my class Zoom account so that online students can join the class already (see **Figure 2**).

Presentation

At 10 in the morning, I started the class by checking the class attendance. Next, I launched the online Socrative application for 15 min of vocabulary exercise. I considered this online vocabulary exercise helpful in the hybrid classroom instruction because it has become a common application both for online and onsite students to join the class exercise.

Following the online vocabulary exercise, I proceeded to share my Zoom screen to make my lesson PowerPoint slides visible for onsite and online students. For onsite students, they could see the lesson PowerPoint through a multimedia projector, while online students could see it through the shared Zoom screen. I had to use the microphone so that online students could hear my lesson discussion. Likewise, I had to limit my "teacher time" or lesson discussion to 30 to 45 min so that students could have time to interact, discuss, and share ideas. To check their comprehension, I would call some students either online or onsite to recall what I said.

After my "teacher time," I would always have a breakout room discussion where students were given a space to engage with each other regarding our lesson. I always had a question or two as their point for discussion. Onsite students could join their online classmates in the breakout rooms or form their groups in the classroom. In case onsite students wanted to join the breakout room discussion with their online classmates, they needed to open their Zoom account and log in to participate. However, some onsite students usually preferred to create one or two groups with their classmates in the classroom.

The breakout session was limited to 30 min only, and students should be back to the main room to share their group discussion with the rest of the class. Students were advised to be creative in their group discussion sharing. They could present their discussion in a PowerPoint or they could do a discussion role-play.

When online students returned to the main room, I facilitated the group sharing discussion by calling some volunteer groups to share first. Otherwise, I let the onsite students share first their group discussions by using the microphone and the web camera facing them so that they would be seen and heard by their online classmates. Online and onsite students were also encouraged to ask questions or supplement the group discussion. The group discussion sharing lasted for 20 to 30 min. Lastly, I gave my students a comprehension exercise either in Socrative or Google form platform.

Every week for 12 weeks, this was how I conducted my synchronous hybrid classroom instruction. Fortunately, the record feature in Zoom allowed me to record and save the

video for online students who faced a problem with an internet connection. The recorded hybrid classroom instruction videos were posted in our closed-class Facebook group. Online students who missed the class due to internet issues could still engage in the class discussion asynchronously by sharing their ideas in the comment section of the post on our closed-class Facebook group.

Reinforcement

Since the course is a general English language course focusing on reading and writing, other reinforcement language activities were done in an asynchronous learning modality. I utilized another online platform, Facebook, for other independent language learning activities in this asynchronous learning modality. For example, every three weeks, we had an asynchronous writing class discussion posted in our class closed-Facebook group, where everyone was a member. Such an asynchronous writing activity required students to respond to my question in not more than 200 words based on our hybrid class lesson of the day. They were given one week to respond to the discussion question and one of their classmate's answers.

For asynchronous reading activities, I usually gave my students google form links, which I posted on our closed-Facebook group to access, read, and answer the reading comprehension questions (see **Figure 3**).

REFLECTION

Given the current context where the COVID-19 is still affecting students' decision to return to the campus and study in the physical classroom, the teacher reflected that conducting a hybrid class offered an opportunity and choices for students to study online or onsite. In other words, hybrid teaching addressed and catered to students' language learning preferences during this unprecedented time. Although there were still a number of students who were not confident about returning to the campus, there were also some students who were excited and happy to go back to residential classroom teaching, considering the fact that they were locked in their homes, where they only did online learning for over a year. For the teacher, he was also glad to meet his students in person, especially since they were still first-year students who were excited about becoming university students.

Based on the teaching practice presented, it can be noted that hybrid teaching requires a teacher to have strong pedagogical skills (previous teaching experience) and knowledge and affordances of the online platforms. The teacher observed and perceived that a key to a successful hybrid classroom instruction, where online and onsite students were simultaneously learning, was the availability of technological equipment and platform. He noted that a hybrid classroom should have a multimedia projector, a computer connected to the internet, a web camera, a microphone, and an online platform (Zoom). Without these tools, he believed that a hybrid classroom would not work. Additionally, he also reflected that hybrid teaching was more challenging than fully online teaching as he dealt with students in "two worlds." This suggests that whenever he planned for his lesson, he did not think only of his online students but also considered his onsite students. He wanted to give equal attention to two groups of students, especially in the various language learning activities. He found it challenging to arrange students for group discussion since he had onsite students, and he wanted them to interact with their online classmates. However, he also found a way to address this issue by encouraging his onsite students to join their online classmates in the breakout room session. Otherwise, onsite students were grouped with their fellow onsite classmates. Nevertheless, he emphasized that "class time" for students' group discussion should be part of the hybrid classroom instruction.

Another important reflection from the teacher was on how he presented his lesson. He believed that coming to his hybrid classroom instruction required a lot of preparation, especially his teaching and learning materials. He had to prepare a PowerPoint presentation, the online links to his language learning activities, and a breakout room group discussion to facilitate the teaching and learning engagement between him and his students. He was also aware that he had to limit his "teacher time" and focus more on "students' time" where students had to be in their groups and discuss and share their ideas, promoting a sense of learning community.

He also observed that students were participative and creative during their group discussions and presentation. He realized that if students were given such a space and time to engage in learning activities, they could perform well and learn from each other.

Lastly, the teacher also perceived that reinforcement activities should be given in an asynchronous mode of learning delivery to allow students to work on their own, becoming independent learners. However, he noted that such asynchronous learning activities should be given as assignments where students work at their own pace. Thus, another online platform where students can engage in asynchronous learning activities was needed. In this case, he used his class closed-class Facebook group for all his asynchronous learning activities.

CONCLUSION

Hybrid teaching may not be a new teaching method; however, how other studies in the literature described and implemented such teaching methodology was rather problematic and ambiguous since it is always used interchangeably with blended learning. In addition, in most studies in the literature, such a teaching method was implemented during the pre COVID-19 pandemic. However, in this teaching practice article, we identified the features of hybrid classroom instruction and how hybrid teaching methodology was implemented in a university in Thailand during the COVID-19 pandemic. We argue that hybrid teaching is synchronous teaching of students in the classroom and online simultaneously using an online platform, Zoom. This definition is in contrast with Singh et al. (2021), who mentioned that "online interactions in a hybrid medium of instruction can be completed either synchronously using real-time meeting sessions or asynchronously where students interact at different times" (p. 142). As a teaching method, hybrid teaching emphasizes the availability of technological equipment and platform such as a multimedia projector, a computer connected to the internet, a web camera, a microphone, and an

online platform (Zoom). Likewise, it also addresses students' learning preferences considering that the COVID-19 cases still counted and some students were not yet ready to be back on campus. However, like any other teaching methodologies, especially when teachers lack training, orientation, and skills in employing such a teaching method, it also means teaching issues. Thus, it is crucial that support be given to the teachers by providing them training on hybrid teaching.

Although this teaching practice is limited only to a specific context, a university in Thailand, it offers implications that education practitioners, scholars, and policymakers can consider when conducting a hybrid classroom instruction. First, the teacher utilized Zoom's platform for his online students to join his hybrid class. Although Zoom may be a good platform for online teaching as it has features for screen-sharing and breakout room discussions, other online platforms should also be considered, especially since Zoom requires a premium account to access these features. Using Microsoft Teams, Google Meet, Facebook, and Google classroom may provide different perspectives and practices in hybrid teaching. Second, hybrid teaching is believed to provide an alternative method during the COVID-19 pandemic or post COVID-19 education. However, it requires some tools to make it work, and schools should consider the availability of these tools in their context before implementing such a teaching methodology. Third, as emphasized earlier, teachers need training before shifting to hybrid classroom instruction. Although teachers may utilize their existing pedagogical knowledge and skills in conducting hybrid teaching, providing them with the necessary training would equip them, making them confident to deliver their lessons. Fourth, learners are important clients in hybrid teaching. Thus, teachers who embark on doing hybrid teaching should consider their teaching and learning materials whether or not they support the learning needs of their students so that students' engagement and active participation in the hybrid classroom instruction are ensured.

For future research, exploring more on the concept of hybrid teaching from a different perspective and context would offer new insight into its conceptualization and practice.

AUTHOR CONTRIBUTIONS

MU contributed to conception and design of the manuscript. WP contributed the teaching practice and the reflection. Both authors contributed to the article and approved the submitted version.

REFERENCES

Chakraborty, P., Mittal, P., Gupta, M. S., Yadav, S., and Arora, A. (2021). Opinion of students on online education during the COVID-19 pandemic. *Hum. Behav. Emerg. Technol.* 3, 357–365. doi: 10.1002/hbe 2.240

Chen, B. H., and Chiou, H. H. (2014). Learning style, sense of community and learning effectiveness in hybrid learning environment. *Int. Learn. Environ.* 22, 485–496. doi: 10.1080/10494820.2012.680971

Dowling, C., Godfrey, J. M., and Gyles, N. (2003). Do hybrid flexible delivery teaching methods improve accounting students' learning outcomes? *Acc. Educ.* 12, 373–391. doi: 10.1080/0963928032000154512

Drewelow, I. (2013). Exploring graduate teaching assistants' perspectives on their roles in a foreign language hybrid course. *System* 41, 1006–1022. doi: 10.1016/j.system.2013.09.007

Garrison, D. R., and Kanuka, H. (2004). Blended learning: uncovering its transformative potential in higher education. *Int. High. Educ.* 7, 95–105. doi: 10.1016/j.iheduc.2004.02.001

Garrison, D. R., and Vaughan, N. D. (2013). Institutional change and leadership associated with blended learning innovation: two case studies. *Int. High. Educ.* 18, 24–28. doi: 10.1016/j.iheduc.2012.09.001

Kansal, A. K., Gautam, J., Chintalapudi, N., Jain, S., and Battineni, G. (2021). Google trend analysis and paradigm shift of online education platforms during the COVID-19 pandemic. *Infect. Dis. Rep.* 13, 418–428. doi: 10.3390/idr13020040

Klimova, B. F., and Kacetl, J. (2015). Hybrid learning and its current role in the teaching of foreign languages. *Proc. Soc. Behav. Sci.* 182, 477–481. doi: 10.1016/j.sbspro.2015.04.830

Lin, O. (2008). Student views of hybrid learning: a one-year exploratory study. *J. Comput. Teach. Educ.* 25, 57–66. doi: 10.1080/10402454.2008.10784610

Linder, K. E. (2017). Fundamentals of hybrid teaching and learning. *New Direct. Teach. learn.* 149, 11–18. doi: 10.1002/tl.20222

Maatuk, A. M., Elberkawi, E. K., Aljawarneh, S., Rashaideh, H., and Alharbi, H. (2022). The COVID-19 pandemic and E-learning: challenges and opportunities from the perspective of students and instructors. *J. Comput. High. Educ.* 34, 21–38. doi: 10.1007/s12528-021-09274-2

Moorhouse, B. L., and Wong, K. M. (2022). Blending asynchronous and synchronous digital technologies and instructional approaches to facilitate remote learning. *J. Comput. Educ.* 9, 51–70. doi: 10.1007/s40692-021-00195-8

Neuwirth, L. S., Joviæ, S., and Mukherji, B. R. (2021). Reimagining higher education during and post-COVID-19: challenges and opportunities. *J. Adult Contin. Educ.* 27, 141–156. doi: 10.1177/1477971420947738

Nhu, P. T. T., Keong, T. C., and Wah, L. K. (2019). Issues and challenges in using ICT for teaching English in Vietnam. *CALL-EJ* 20, 140–155.

O'Byrne, W. I., and Pytash, K. E. (2015). Hybrid and blended learning. *J. Adolesc. Adult Lit.* 59, 137–140. doi: 10.1002/jaal.463

Oliver, M., and Trigwell, K. (2005). Can 'blended learning' be redeemed? *Elearn. Dig. Media* 2, 17–26. doi: 10.2304/elea.2005.2.1.17

Saichaie, K. (2020). Blended, flipped, and hybrid learning: definitions, developments, and directions. *New Direct. Teach. Learn.* 164, 95–104. doi: 10.1002/tl.20428

Sayıner, A. A., and Ergönül, E. (2021). E-learning in clinical microbiology and infectious diseases. *Clin. Microbiol. Infect.* 27, 1589–1594. doi: 10.1016/j.cmi.2021.05.010

Singh, J., Steele, K., and Singh, L. (2021). Combining the best of online and face-to-face learning: hybrid and blended learning approach for COVID-19, post vaccine, & post-pandemic world. *J. Educ. Technol. Syst.* 50, 140–171. doi: 10.1177/00472395211047865

Smith, K., and Hill, J. (2019). Defining the nature of blended learning through its depiction in current research. *High. Educ. Res. Dev.* 38, 383–397. doi: 10.1080/07294360.2018.1517732

Solihati, N., and Mulyono, H. (2017). A hybrid classroom instruction in second language teacher education (SLTE): a critical reflection of teacher educators. *Int. J. Emerg. Technol. Learn.* 12, 169–180. doi: 10.3991/ijet.v12i05.6989

Ulla, M. B., and Achivar, J. S. (2021). Teaching on Facebook in a university in Thailand during the COVID-19 pandemic: a collaborative autoethnographic study. *Asia Pac. Soc. Sci. Rev.* 21, 169–179.

Ulla, M. B., and Perales, W. F. (2021a). Emergency remote teaching during COVID19: the role of teachers' online community of practice (CoP) in times of crisis. *J. Int. Media Educ.* 9, 1–11.

Ulla, M. B., and Perales, W. F. (2021b). Facebook as an integrated online learning support application during the COVID19 pandemic: Thai university students' experiences and perspectives. *Heliyon* 7:e08317. doi: 10.1016/j.heliyon.2021.e08317

Vernadakis, N., Antoniou, P., Giannousi, M., Zetou, E., and Kioumourtzoglou, E. (2011). Comparing hybrid learning with traditional approaches on learning the Microsoft Office Power Point 2003 program in tertiary education. *Comput. Educ.* 56, 188–199. doi: 10.1016/j.compedu.2010.08.007

frontiers | Frontiers in Education

Teaching of Human Parasitology During the COVID-19 Pandemic in China

Sheng-Qun Deng*†, Mu-Zi He†, Wei Wang, Chao Zhang, Ji-Jia Shen, Ji-Long Shen, Yi-Nan Du* and Miao Liu*

Department of Pathogen Biology, The Key Laboratory of Microbiology and Parasitology of Anhui Province, The Key Laboratory of Zoonoses of High Institutions in Anhui, School of Basic Medical Sciences, Anhui Medical University, Hefei, China

Since the coronavirus disease 2019 (COVID-19) pandemic, human parasitology education has been exceedingly disrupted. To deliver human parasitology knowledge, medical universities in China have employed multiple measures, some of which have had positive outcomes that have not yet been summarized. The objective of this review is to share the Chinese experience as the human parasitology teaching methods were transformed. In general, we adopted a fully online teaching model under urgent pandemic control measures based on a well-structured teaching model that integrated the course preview, live lecture, review, and assessment. Combinations were attempted of COVID-19 and parasitology teaching contents. Some active learning models, such as case-based e-learning and flipped classrooms, were proposed for offline and online blended teaching during the normalization stage of the pandemic. Meanwhile, we discuss both the strengths and flaws of online and blended teaching. Some useful assessment tools are presented for reference purposes. In conclusion, this transition to online and online-offline blended human parasitology teaching in China has boosted innovative teaching activities and may continue to catalyze the transformation of medical education.

Keywords: China, COVID-19, human parasitology, teaching model, e-learning, medical education

INTRODUCTION

Coronavirus disease 2019 (COVID-19), which suddenly struck China in December 2019, has spread worldwide (Centers for Disease Control Prevention, 2021a). Such a severe pandemic has challenged all aspects of society – factories were shut down, transportation was limited, and all on-campus activities were postponed (Sharifi and Khavarian-Garmsir, 2020).

However, this global health crisis offered opportunities to accelerate the current transformation of higher education. China's authoritarian regime launched the slogan, "suspend classes without suspending learning" (Ministry of Education in China, 2020), which required institutions to perform remote online teaching to comply with the nationwide home-based quarantine strategy.

Abbreviations: COVID-19, coronavirus disease 2019; MOOCs, massive open online courses; CBEL, case based e-learning; FC, flipped classroom; BOPPS, Bridge-in, Objective, Participatory learning, Post-assessment, and Summary; SERU, student experience in the research university.

As a significant branch of medical sciences, human parasitology is a compulsory course for the undergraduate major in clinical medicine and includes knowledge of the parasites that affect humans and important host–parasite relationships. Because of the urgent need to secure the educational continuity of human parasitology under the COVID-19 outbreak, the human parasitology teaching model in China has undergone an unprecedented change from traditional face-to-face teaching to initially an online model and subsequently a new hybrid one. Students encountered many difficulties during online teaching, such as a decrease in motivation, feelings of loneliness, technical problems, and decreased interaction with teachers and other students (Lorenzo-Lledó et al., 2021). The teaching staff also reported unfamiliarity with remote teaching. This paper introduces various teaching methods and tools to solve these difficulties, and we share our reflections regarding the innovations in human parasitology teaching during the outbreak in China.

ONLINE TEACHING OF HUMAN PARASITOLOGY DURING THE EMERGENT STAGE OF COVID-19

At the beginning of the pandemic, one of the vital characteristics was that neither the staff nor the students were prepared for absolute web-based education. Online teaching had previously complemented face-to-face teaching, but it then began to dominate education. This model made it possible to deliver knowledge to massive crowds without the threat of human-to-human disease transmission. Meanwhile, the geographical barriers and temporal spaces, which contributed to large-scale information broadcasting.

Many efforts were made to ensure the success of remote human parasitology teaching. For instance, specific training programs for computer skills and software were set up for teachers to enhance their familiarity with devices. Lectures on online teaching techniques were given for the same goal. For students, considering their constant exposure to digital devices, some student-aimed brochures about the platform usage were adequate. Moreover, some departments required rehearsals before formal classes to test the environment and internet connections with students. To ensure educational equity, for students with family poverty, universities established funding sources to cover the network expenses caused by online learning.

The human parasitology course in China is composed of theoretical lectures and experimental practice (Zhao et al., 2012). For the lectures, the goals for undergraduate students are as follows: first, comprehending the morphological features, life cycles, and pathogeneses of primary parasites; second, understanding the pathogenic mechanisms of parasite-related diseases; and third, knowing about the diagnosis, treatment, prevention, and control of parasitic infections (Zhao et al., 2012). As a result, a well-structured model was developed to satisfy these requirements in human parasitology teaching during the COVID-19 pandemic (**Figure 1**). This model consisted of four parts: preview, live lecture, review, and assessment. The key

elements in the process and some useful teaching tools were listed in the framework to aid teachers in their pedagogical practices.

In the preview, students were offered the key points of the course and some learning videos. The findings of previous studies have shown that through videos, students gain a more effective learning experience, and videos provide a powerful mechanism for instructors to facilitate various multimedia learning principles (Oakley and Sejnowski, 2019). Prerecorded videos could be downloaded for massive open online courses (MOOCs). Nevertheless, the preview video length should be restricted to 20 min, as long sessions decrease students' interest. Apart from the length, during the preview, teachers are encouraged to issue a few questions via the platform. Students can choose either to write their thoughts in the comments area or to keep these questions in mind and learn the answers later in class.

The live lectures integrated multiple models that received positive anecdotal feedback from participants. The application (i.e., Rain Classroom, a new smart solution for online live teaching jointly developed by Tsinghua University and Xuetang Company in China) allowed the real-time sharing of PowerPoint and voice/video broadcasting. More importantly, students could post bullet screens at any time to interact with their professors. These bullet screens could be seen by classmates, and the screens could be collected and analyzed by the background database. Afterward, a "keyword cloud" was presented according to the appearance of different words that the program (i.e., Wordle) captured, which is also called data visualization. In a survey, data visualization was found to be a useful tool: student grades were higher after data visualization was implemented and a questionnaire indicated 93.75% positive feedback (Vega-Garzón et al., 2021). In combination with online quizzes, the impact of data visualization is maximized. The accuracy rates of the whole class along with the proportion of the accuracy rates for each selected option can be shown on slides that enable learners to monitor their progress and recognize weaknesses in certain knowledge areas (Jabbar et al., 2016). Furthermore, a backup plan was always in place in case of a platform breakdown or connectivity problems. Other audiovisual conferencing software platforms such as Tencent QQ, Ding Talk, and Zoom (mainly for international students) were constantly considered substitutes.

Additionally, the teaching content could be enriched with some COVID-19 studies related to parasitology. For example, during the interdisciplinary session with immunology, instructors introduced the way intracellular pathogen SARS-CoV-2 interacts with receptors located on the surface of mammalian cells, a method that is also used by prokaryotic and eukaryotic microorganisms (de Souza, 2020). The control of parasitic diseases was linked to COVID-19 control, as both measures include treating the source of infection, blocking the infection route, and protecting the susceptible population. Such teaching methods aroused students' interest in parasitology and cultivated their One Health awareness (Sinclair, 2019).

The instructors were advised to attach extra learning materials to the platform after live teaching, including links to external online resources and open questions. For example, regarding *Plasmodium*, related research articles and reference books about

FIGURE 1 | Human parasitology online teaching model during the COVID-19 pandemic.
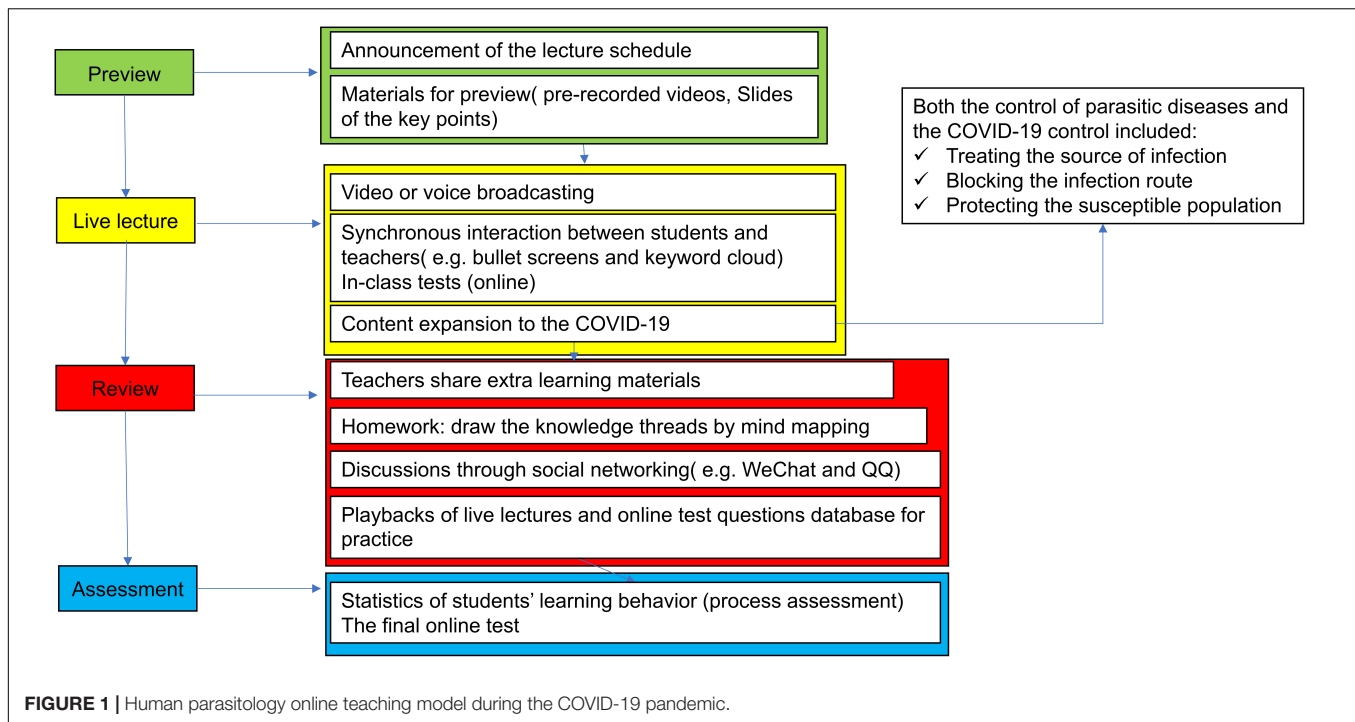
mainstream prevention measures could be listed to prompt self-directed study by the students. The students were encouraged to draw knowledge threads by mind-mapping to summarize the content of certain parasites. Discussions between the teachers and students were available through social networking (e.g., WeChat and QQ). To some extent, the social application broke the boundary of conventional classroom teaching, in which the students often felt stressed during discussions, and helped to create a multicenter debate model for convenient interactions between students and teachers. In this model, more students could participate in the debate synchronously without disturbing one another, and some introverted students were more willing to express their opinions by posting in the chat room. Some creative ideas were introduced to our practical teaching under this model. The students assigned nicknames to common parasites based on the features. For example, *Entamoeba histolytica* was called "the culprit for flask ulcer," and *filaria* was named "the silk net that blocks the lymphatic vessel." This naming game made studying more enjoyable, and the teachers applied these interesting topics to the human parasitology MOOCs, which was welcomed by the students.

Another positive feature about the online education platforms was the unlimited playback feature for live lectures, allowing absent students to catch up and others to review. The platform also provided an online test question database for students to review their learning outcomes and automatically adjust their self-learning plan.

With regard to practical lessons, the faculty adopted a method combining online lecture and virtual laboratory to provide students with valuable scientific learning experiences when in-person learning was not possible (Delgado et al.,

2021). In this section, students were required to observe the morphological features of select parasites and conduct practical operations concerned with immunological and molecular biology technologies (Zhao et al., 2012). The theoretical parts of the experiment were illustrated via Rain Classroom. For instance, some pathological sections of high definition were posted to the platform, where the students could magnify the picture for details while listening to the teachers' interpretation. Later, the students' drawings of these sections were delivered to the teachers online. Furthermore, with the assistance of universities' elibrary resources, the students had free access to a variety of websites ranging from The Journal of Visualized Experiments to Springer Protocols. Although hands-on experiments could not be performed during remote teaching, the university's virtual and national simulation experimental teaching center provided students with experience from more intuitive, microscopic, and personal perspectives. Some experiments, such as the circumoval precipitin test, which used to be difficult for students to enroll in, can now be carried out repeatedly via multimedia methods (e.g., animation and interactive games). With these tools, the instructor taught the students lab theory, scientific methodology, data analysis, and critical thinking skills to overcome scientific obstacles (Delgado et al., 2021).

Given the lockdown, offline examination papers were no longer suitable for student evaluations. Instead, a more procedure-centered and diversified assessment system was implemented. The system consisted of a process assessment (40%), in-class tests (5%), homework (15%), and an online final exam (40%). In contrast to traditional test papers, the clinical case analyses took the online final test more into account, and the proportion of multiple-choice questions was increased.

Since invigilation was hard to achieve when the students were behind a remote computer screen, the sequence of questions was randomized for individuals, and the number of questions was doubled while the timing remained the same. Before the grades were released, the students evaluated and commented on the human parasitology subject (Liu et al., 2018). In addition, student attendance, class duration, and other statistics related to students' learning behaviors were available to the teachers. Based on these intelligent analyses of the entire class, the teachers made adjustments for the future courses.

ONLINE–OFFLINE BLENDED TEACHING OF HUMAN PARASITOLOGY DURING THE NORMALIZATION STAGE OF COVID-19

Because the SARS-CoV-2 spread was successfully controlled in China, the management of the COVID-19 pandemic entered a normalization phase. Students with negative results in the detection of SARS-CoV-2 were permitted to return to school. Although universities in high-risk regions implemented an isolation policy to protect students from external infection, students and staff returned to face-to-face teaching after a 2-week self-quarantine in the dormitory.

With the experience of full online teaching, the universities developed a blended methodology (online–offline blended teaching). The blended method took advantage of the software's recording and polling functions, which were highly appreciated by the students in the classroom, and many of the students claimed that they were better able to concentrate on the course. In addition to serving as a regular teaching model, the digital platform was used in the modified case-based e-learning (CBEL) model and flipped classroom (FC) (Sawras et al., 2020).

The online–offline blended teaching method of human parasitology was derived from the modified Bridge-in, Objective, Participatory learning, Post-assessment, and Summary (BOPPS) model (Wang et al., 2021). This model divided the teaching activity into multiple pieces to better explain the framework of blended teaching pedagogies. The bridge-in was the introduction to the human parasitology course, and the objective was the learning goal, both of which were achieved through offline teaching. Participation was reflected in the CBEL and FC patterns (**Figure 2**), which highlighted self-directed learning, from which the students should be able to ultimately assess and summarize the lesson.

In the modified CBEL, parasite-related clinical cases were shared on the digital platform. The chosen cases should be openly discussed, close to daily life, and combined with current affairs (COVID-19). For example, we designed a case in which an expectant mother was infected with *Toxoplasma gondii* because she raised cats but also had close contact with confirmed COVID-19 patients (Khedmat et al., 2021). In a sense, this creative combination required a more comprehensive understanding of this parasite. Considering that the students could not find COVID-19 knowledge in the textbook, they were forced to research newly published academic literature and make connections to the case. The students were distributed into small groups for discussion. As they brainstormed, the students could post some materials they found into their group chats for others to refer to and analyze the case from multiple aspects. Generally speaking, the brainstorming usually focused on the medical history, clinical manifestations, and abnormality of the laboratory and imaging tests to provide possible diagnosis and treatment (**Figure 2**). After the offline group meetings, new findings were exchanged on the platform, which the members could check at their convenience or discuss further without gathering in person. The teachers could also use this platform to monitor the preparation procedure and evaluate personal performance. For some students who were not physically present at the university, video conferencing software was highly recommended. In the reporting stage, both the teachers and other groups were encouraged to raise doubts and questions, and the presenters had to defend their positions with their background knowledge and previous research results. After the presentations, the students had to submit their summary reports online. At last, the teacher assessed individual performances and helped the students integrate their learning outcomes into clinical practice.

The whole CBEL model was a student-centered framework (David, 2017). The framework integrated different curricula, such as human parasitology, clinical diagnostics, pharmacology, physiology, and psychology. Throughout this learning, participant collaborations were enhanced. After they analyzed clinical cases, students were supposed to independently discover questions sentence by sentence. In this active-learning setting, students improved their problem-solving and critical thinking skills as well as their interactivity (David, 2017). Each group member played different roles in the scenarios, which gave students the freedom to develop their personal interests. Moreover, the application of digital devices and resources provided the participants with convenience and efficiency, making the project more interactive.

In the FC pattern, the process by which students self-taught and prepared their presentations was similar to the active learning setting in CBEL. For example, a few chapters of parasitology were taught by the students. They were asked to design teaching plans and make PowerPoints that would be peer-reviewed by classmates. The teachers recorded the students' lectures on the digital platform and commented on their performance (**Figure 2**). These teaching tools were encouraged so the students could gain more experience. As a reversal of traditional teaching, the FC facilitates the active learning required in student-centered tasks to acquire knowledge (Jabbar et al., 2016). It can also be a tool to measure students' basic learning outcomes of parasitology and their knowledge system of medicine. However, according to a previous survey, students in the FC reported more burden and pressure than did those in lecture-based methods (Tang et al., 2017). The timing of the FC needs to be controlled, and the proper guidance of tutors is advised to lessen students' burden. Both the CBEL and FC models were modified based on the instructors' experience in full online teaching, which was a good sign for the long-term development of human parasitology education.

FIGURE 2 | Modified case-based e-learning (CBEL) and the flipped classroom (FC) in online–offline combined teaching during the normalization stage of COVID-19.
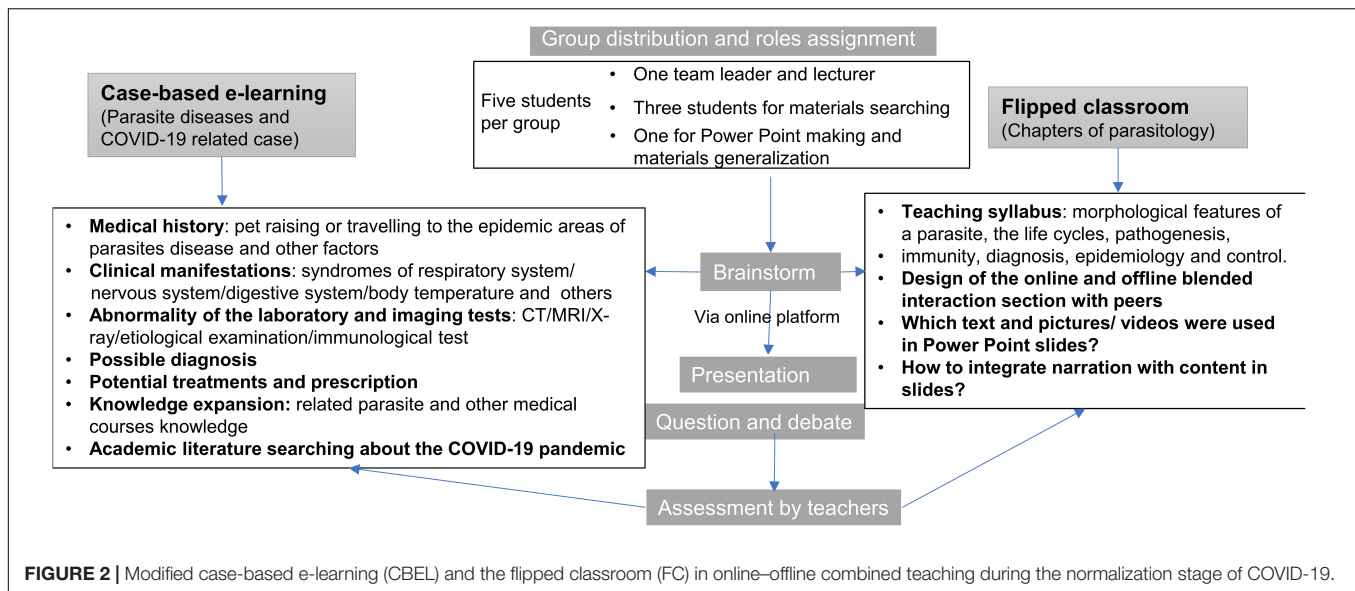
Our retrospective transformation of human parasitology teaching led to certain advancements. The online and online–offline hybrid models integrated several new pedagogies, including the student-centered concept, active learning, and the BOPPS model. These pedagogies permitted human parasitology teaching to be completely transformed along with its theoretical bases, grounding the innovation. The joint use of these pedagogies increased the emotional bond between teachers and students and the course interactivity, both of which caused some students to be more interested in human parasitology and to possibly take it as their future major. Meanwhile, both the online and blended methods created a learning community for students. The leading role that teachers played in traditional teaching was replaced by the students' group learning. The learners could communicate with each other via the platform and create an active atmosphere while the teachers supervised the procedure and offered supplementary guidance. Thus, not only did the students benefit from the community, but the teachers also reported more connection and achievability (Roussel et al., 2020).

ASSESSMENT OF THE TRANSFORMATION OF THE HUMAN PARASITOLOGY TEACHING MODEL DURING THE COVID-19 CRISIS

The learning objectives of human parasitology have undergone some changes during the COVID-19 pandemic. In the traditional offline teaching and the beginning stage of online education, one learning objective was to build a clear view for students that parasitic disease were still heavy burdens for public health systems globally. Another learning objective was to help students understand the basic knowledge of commonly seen parasitic disease including the prevalence of parasitic disease and the main principles for parasitic disease control and treatment. However, integrations between the parasitic disease and the COVID-19 pandemic knowledge were tried both in the online teaching and blended teaching of human parasitology. Therefore, the focus of learning objectives for this course has expanded to its relation to global health emergencies (COVID-19 pandemic) and the main principles for infectious disease treatment to cultivate a global view on public health for students.

COVID-19 sped the integration of educational theories in human parasitology teaching assisted by new technologies. A majority of the digital platforms were equipped with blockchain, big data, data visualization, and virtual reality technologies. Blockchain is being used to build new interventions to improve the prevailing ways of sharing, delivering, and securing knowledge data among universities and to maintain personal learning records (Raimundo and Rosário, 2021). Big data are applied to analyze students' learning behavior. Overall, digital technologies are likely to be further integrated into higher education after the epidemic.

With advanced pedagogies and technologies, the reformation of human parasitology teaching in China throughout the COVID-19 situation has shown great practical value. In a published evaluation of online synchronous clinical training during the COVID-19 pandemic, students particularly enjoyed keeping in contact with peers and tutors when offline learning activities were canceled (Junod Perron et al., 2020). With higher perceived ease of use and usefulness of online education, students will have stronger motivations to switch from offline to online learning platforms (Jin et al., 2021). In this context, online courses also boosted their motivation to learn and created a student-centered learning community. With the application of virtual laboratories in online education, there was less need for technician presence which helps to save more human resources, time, and expenses. The use of experimental animals was also reduced which satisfied the 3R principles- replacement, reduction and refinement. The virtual laboratories were proved

to minimize instructor dependency, which was of importance for students to develop practical skills (Radhamani et al., 2021). In a qualitative assessment of an online laboratory experiment among students, of the 8 categories about quality of course procedures, 6 had mostly positive feedbacks while two were mostly negative (King et al., 2021). For the online-offline hybrid models, owing to the convenience that digital devices provided, students got more involved in the class, and the student-centered framework was able to be fulfilled easily. The experience from early full online teaching has ensured the rapid adaptation into new CBEL and FC models for both teachers and students.

We have received some positive feedback from students. For example, a student from clinical medicine said that online human parasitology teaching provided more learning freedom, and the preview was supervised via a digital platform which helped her to understand the key knowledge like the life cycle and morphological features of parasites. Another international student claimed that the online teaching of human parasitology was able to track down his learning process which enhanced his self-discipline in studying, and the virtual laboratory section was very intriguing where the incorrect operations were indicated and rectified automatically.

However, this model has some limitations. It cannot fulfill the requirements for research-based studies for postgraduates. The platforms need to be improved to accommodate the high volumes of students and the large scale of remote learning experienced during the pandemic, meaning the domestic infrastructure must be improved of the internet and communication. In the future, perhaps the problems will be solved with more advanced technology or design. What's more, students still had a sense of isolation during online education which couldn't be fully erased by social networking interaction (e.g., WeChat and QQ). Based on an interview survey of college students, the COVID-19 pandemic may cause several psychological disorders including sleep deficiencies, depression, anxiety, and even post-traumatic stress disorder in the student group (Salari et al., 2020). These may relate to academic stresses and the loss of social contact with both classmates and teachers in online teaching. With regard to online-offline blended teaching, CBEL and FC patterns made up for the losses of social contact, but the efforts to learn how to play leading roles via a digital platform in class may load more extra burdens for students. And students got distracted easily by digital devices and the CBEL, as well as FC models, restrained the number of students involved in the class (usually under 15) which increased the burden on human resources and teaching fields. In online-offline hybrid models, students' enthusiasm and participation in the CBEL and FC models were closely related to their personalities and levels of experience (Chen et al., 2022). For online experiment education, an authentic learning experience of hands-on experiments was indispensable for laboratory skill training, and students will still require this exposure which can be achieved through offline classes. Apart from that, the losses of recording actual data that students got from their hands-on tests for analysis may decrease their interest to explore parasitology experiments.

Additionally, this unusual transition that the COVID-19 pandemic caused has raised higher command of the present students' performance system. The proportion of process evaluation in final grades was added to online education. But in the CBEL and FC models, the learning effectiveness became rather diverse so that the grades given by only teachers may not fully reflect students' actual performance. To complement this flaw, the student experience in the research university (SERU) survey could be added in the future which adopted a retrospective pretest and a current post-test (that is, a "then" and "now") design to measure student learning outcomes (Douglass et al., 2012). This evaluation method was useful to identify changes that students experienced subjectively in the student-centered framework, and the scores given by teachers together with SERU survey results may create a more subjective grade for students.

To better assess these pedagogical strategies, the following tools were recommended. Online anonymous questionnaires about the effectiveness of different teaching methods could be distributed to students. For example, students may be asked to report their confidence in different teaching methods based on the Likert scale (Stoehr et al., 2021). The commonly used scale was five points, for instance, when using a certain method to discuss a parasite with peers, students could report their confidence with 1 being not confident at all, 2 being unconfident, 3 being neutral, 4 being confident and 5 being extremely confident. The data from different majors were collected, and the following years of data could be analyzed to give a comprehensive assessment. The students' grades on human parasitology were also available for comparison among different teaching methods. And a semi-structured interview in which students were allowed to express their opinions freely was used to assess online education during the COVID-19 pandemic as well (Bıyık et al., 2021; Chen et al., 2022). Our experience may offer meaningful lessons for human parasitology teaching in other countries. At present, countries worldwide remain under the threat of the pandemic (Centers for Disease Control Prevention, 2021a), and many international students are unable to attend offline classes (The Organisation for Economic Co-operation and Development, 2021). Therefore, such a teaching model is quite suitable, and the model framework permits various adaptations based on teaching goals or countries' situations to guarantee the continuity of human parasitology teaching.

CONCLUSION

From 2019 to 2021, COVID-19 changed human parasitology education greatly in terms of both teaching methods and content. We adopted full online teaching to comply with urgent pandemic control measures and transitioned to a blended model in the present normalization stage. Different methodologies such as virtual laboratory, BOPPS model, and student-centered framework were mixed to enhance students' learning outcomes and their interest in human parasitology. The transition to online and online-offline blended teaching has boosted innovative online teaching activities and enhanced teachers' digital literacy.

During the online education, a well-structured teaching model that integrated the course preview, live lecture, review, and assessment was developed. The CBEL and FC modes were also conducted during the blended teaching of human parasitology. Moreover, we discussed the strengths along with flaws about the above teaching methods for a more subjective assessment, and some possible assessment measures were also presented. These reflections on the changes in the human parasitology teaching model can provide experience and insights for the future. According to the latest report, the Omicron variant, which may spread more easily than the original SARS-CoV-2 virus, has been detected in the United States (Centers for Disease Control Prevention, 2021b). The subsequent stage may witness further challenges because the pandemic is a dynamic situation, but our experience could prepare human parasitology teaching for a sudden switch between the present hybrid teaching method and fully online teaching under conditions of urgent pandemic control. Moreover, many interesting and innovative practices, such as teaching contests regarding human parasitology education, can be carried out to improve the development of medical education and provide fundamentals for future global crises, such as the COVID-19 pandemic.

AUTHOR CONTRIBUTIONS

S-QD: conceptualization. S-QD and M-ZH: methodology. M-ZH, ML, Y-ND, and S-QD: writing – original draft preparation. M-ZH, WW, CZ, J-JS, J-LS, and S-QD: writing, review, and editing. S-QD, Y-ND, and ML: funding acquisition. All authors have read and agreed to the published version of the manuscript.

FUNDING

REFERENCES

Bıyık, M., Savcı, A., Güçlü, S., Aksoy, C. C., and Perçin Renders, D. (2021). Evaluation of Online Education Provided to Students During the COVID-19 Pandemic: A University Experience. *Florence Nightingale J. Nurs.* 29, 312–323. doi: 10.5152/FNJN.2021.21001

Centers for Disease Control and Prevention. (2021a). *COVID Data Tracker 2021.* Available online at :https://www.cdc.gov/coronavirus/2019-ncov/index.html. (accessed on Dec 14, 2021)

Centers for Disease Control and Prevention. (2021b). *Omicron Variant: What You Need to Know 2021.* Available online at :https://www.cdc.gov/coronavirus/2019-ncov/variants/omicron-variant.html (accessed on Dec 14, 2021)

Chen, M., Ye, L., and Weng, Y. (2022). Blended teaching of medical ethics during COVID-19: practice and reflection. *BMC Med Educ.* 22:361. doi: 10.1186/s12909-022-03431-6

David, A. A. (2017). A Student-Centered Framework for Teaching Undergraduate Parasitology. *Trends Parasitol.* 33, 420–423. doi: 10.1016/j.pt.2017.01.010

de Souza, W. (2020). COVID-19 and parasitology. *Parasitol. Res.* 119, 2369–2370. doi: 10.1007/s00436-020-06719-y

Delgado, T., Bhark, S. J., and Donahue, J. (2021). Pandemic Teaching: Creating and teaching cell biology labs online during COVID-19. *Biochem. Mol. Biol. Educ.* 49, 32–37. doi: 10.1002/bmb.21482

Douglass, J. A., Thomson, G., and Zhao, C.-M. (2012). The learning outcomes race: the value of self-reported gains in large research universities. *Higher Educ.* 64, 317–335.

Jabbar, A., Gasser, R. B., and Lodge, J. (2016). Can New Digital Technologies Support Parasitology Teaching and Learning? *Trends Parasitol.* 32, 522–530. doi: 10.1016/j.pt.2016.04.004

Jin, Y. Q., Lin, C. L., Zhao, Q., Yu, S. W., and Su, Y. S. (2021). A Study on Traditional Teaching Method Transferring to E-Learning Under the Covid-19 Pandemic: From Chinese Students'. *Perspectives. Front Psychol.* 12, 632787. doi: 10.3389/fpsyg.2021.632787

Junod Perron, N., Dominicé Dao, M., Rieder, A., Sommer, J., and Audétat, M. C. (2020). Online Synchronous Clinical Communication Training During the Covid-19 Pandemic. *Adv. Med. Educ. Pract.* 11, 1029–1036.

Khedmat, L., Mohaghegh, P., Veysizadeh, M., Hosseinkhani, A., Fayazi, S., and Mirzadeh, M. (2021). Pregnant women and infants against the infection risk of COVID-19: a review of prenatal and postnatal symptoms, clinical diagnosis,

adverse maternal and neonatal outcomes, and available treatments. *Arch. Gynecol. Obstet.* 2021, 1–13. doi: 10.1007/s00404-021-06325-y

King, C. E., Trevino, C., and Biswas, P. (2021). Online Laboratory Experiment Learning Module for Biomedical Engineering Physiological Laboratory Courses. *Biomed. Eng. Educ.* 1, 201–208. doi: 10.1007/s43683-020-00034-9

Liu, G. H., Zhang, L. X., Zou, F. C., Yuan, Z. G., Zhao, G. H., Hu, M., et al. (2018). Veterinary parasitology teaching in China in the 21st century - Challenges, opportunities and perspectives. *Vet. Parasitol.* 252, 70–73. doi: 10.1016/j.vetpar.2018.01.037

Lorenzo-Lledó, A., Lledó, A., Gilabert-Cerdá, A., and Lorenzo, G. (2021). The Pedagogical Model of Hybrid Teaching: Difficulties of University Students in the Context of COVID-19. *Eur. J. Investig. Health Psychol. Educ.* 11, 1320–1332. doi: 10.3390/ejihpe11040096

Ministry of Education in China. (2020). Guidance of the Office of the Leading Group of the Ministry of Education on Response to the Epidemic of Coronavirus Infection Pneumonia on Organizing and Managing Online Teaching in Colleges and Universities during the Period of Epidemic Prevention and Control. Available online at: http://www.gov.cn/zhengce/zhengceku/2020-02/05/content_5474733.htm (accessed May 28, 2022).

Oakley, B. A., and Sejnowski, T. J. (2019). What we learned from creating one of the world's most popular MOOCs. *NPJ Sci Learn.* 4:7. doi: 10.1038/s41539-019-0046-0

Radhamani, R., Kumar, D., Nizar, N., Achuthan, K., Nair, B., and Diwakar, S. (2021). What virtual laboratory usage tells us about laboratory skill education pre- and post-COVID-19: Focus on usage, behavior, intention and adoption. *Educ. Inf. Technol.* 26, 7477–7495. doi: 10.1007/s10639-021-10583-3

Raimundo, R., and Rosário, A. (2021). Blockchain System in the Higher Education. *Eur. J. Investig. Health Psychol. Educ.* 11, 276–293. doi: 10.3390/ejihpe11010021

Roussel, D., Gordon, P. R., Wagner, J. M., Bardack, M., Sardesai, M. G., and Colbert-Getz, J. M. (2020). The learning community faculty experience: how longitudinal relationships with learners enhance work meaning. *Perspect. Med. Educ.* 9, 343–349. doi: 10.1007/s40037-020-00614-z

Salari, N., Hosseinian-Far, A., Jalali, R., Vaisi-Raygani, A., Rasoulpoor, S., Mohammadi, M., et al. (2020). Prevalence of stress, anxiety, depression among the general population during the COVID-19 pandemic: a systematic review and meta-analysis. *Glob. Health* 16:57. doi: 10.1186/s12992-020-00589-w

Sawras, M., Khosa, D., Lissemore, K., Duffield, T., and Defarges, A. (2020). Case-Based e-Learning Experiences of Second-Year Veterinary Students in a Clinical

Medicine Course at the Ontario Veterinary College. *J. Vet. Med. Educ.* 47, 678–694. doi: 10.3138/jvme.2018-0005

Sharifi, A., and Khavarian-Garmsir, A. R. (2020). The COVID-19 pandemic: Impacts on cities and major lessons for urban planning, design, and management. *Sci. Total Environ.* 749:142391. doi: 10.1016/j.scitotenv.2020.142391

Sinclair, J. R. (2019). Importance of a One Health approach in advancing global health security and the Sustainable Development Goals. *Rev. Sci. Tech.* 38, 145–154. doi: 10.20506/rst.38.1.2949

Stoehr, F., Müller, L., Brady, A. P., Catalano, C., Mildenberger, P., Mähringer-Kunz, A., et al. (2021). Online teaching in radiology as a pilot model for modernizing medical education: results of an international study in cooperation with the ESR. *Insights Imaging.* 12:141. doi: 10.1186/s13244-021-01092-5

Tang, F., Chen, C., Zhu, Y., Zuo, C., Zhong, Y., Wang, N., et al. (2017). Comparison between flipped classroom and lecture-based classroom in ophthalmology clerkship. *Med. Educ. Online.* 22:1395679. doi: 10.1080/10872981.2017.1395679

The Organisation for Economic Co-operation and Development. (2021). *The state of higher education 2021.* Available online at :https://www.oecd-ilibrary.org/education/the-state-of-higher-education_83c41957-en. (accessed on Dec 14, 2021)

Vega-Garzón, J. C., Robayo-Sánchez, L. N., Cruz-Maldonado, O. A., and Cortés-Vecino, J. A. (2021). Visualization Technologies for Learning and Teaching Veterinary Acarology and Entomology. *J. Vet. Med. Educ.* 2021:e20200034. doi: 10.3138/jvme-2020-0034

Wang, S., Xu, X., Li, F., Fan, H., Zhao, E., and Bai, J. (2021). Effects of modified BOPPPS-based SPOC and Flipped class on 5th-year undergraduate oral histopathology learning in China during COVID-19. *BMC Med Educ.* 21:540. doi: 10.1186/s12909-021-02980-6

Zhao, G., He, S., Chen, L., Shi, N., Bai, Y., and Zhu, X. Q. (2012). Teaching human parasitology in China. *Parasit. Vectors.* 5:77.

Professional Sports Trainers' Burnout in Fully Online and Blended Classes: Innovative Approaches in Physical Education and Sports Training

Nguyễn Hoàng Minh Thuận[1], Đỗ Thị Hoài Thư[2] and Nguyễn Nhật Quang[3]*

[1] Department of Sport Management, University of Sport Ho Chi Minh City, Ho Chi Minh City, Vietnam, [2] Division of Education, Southeast Asian Ministers of Education Organization Regional Training Center in Vietnam (SEAMEO RETRAC), Ho Chi Minh City, Vietnam, [3] HQT Education Ltd., Ho Chi Minh City, Vietnam

The COVID-19 pandemic has forced many educational institutions worldwide to establish emergency remote teaching systems. Although online teaching has long been applied in many other subjects, online sports training is still under-researched in developing countries like Vietnam. In Vietnam, sports trainers are innovatively making many efforts to teach sports online amidst such a once-in-many-generations event. Particularly, a gym center chain has been offering two special formats of online courses utilizing virtual reality (VR) and three-dimensional (3D) technologies, namely, fully online and blended courses. The first format comprises 50% asynchronous sessions using VR and 3D technologies to provide trainees with theoretical knowledge and 50% offline sessions for practical skills training. The second format also includes 50% asynchronous sessions using the same technologies; however, the training for practical skills is conducted *via* an e-conferencing platform (Zoom). Fortunately, the blended courses have attracted significant attention from many sports trainees. However, as sports trainers in Vietnam had minimal opportunities to teach online before this epidemic, it is likely that, while teaching these courses, they can encounter moments of burnout, which comprises three dimensions, such as exhaustion, cynicism, and low professional efficacy. Thus, we aim to investigate factors that affected each dimension of burnout among sports trainers, using the mixed-method approach with questionnaires and focus-group interviews within this study. This study suggests practical pedagogical implications for sports trainers and administrators to curb stress and burnout in online sports training courses in times of crisis.

Keywords: burnout, trainers, exhaustion, cynicism, low professional efficacy, fully online teaching, blended teaching

INTRODUCTION

In line with global internet access and information and communication technologies (ICTs) development, online teaching and learning have exponentially grown among higher education institutions (Novikov, 2020). While online instruction has been adopted in diverse subjects in education, online instruction in physical education and sports training still seems scarce due to

its distinct values. Among these values is the "special preparation and operation to communicate and practice the values of physical education" (Antonia and Pierpaolo, 2019; Jeong and So, 2020, p. 2; Laar et al., 2021; Yu and Jee, 2021). As Jeong and So (2020) clarify, students had difficulties securing sufficient space and limited access to necessary supplies for practicing physical activities when engaged in online classes.

The Covid-19 pandemic outbreak, with its profound impacts on the different aspects of society, has forced governments to instigate different measures, including quarantine, social distancing, community lockdowns, travel restrictions, and closure of offices and educational institutions, to prevent the spread of the global epidemic (Chinazzi et al., 2020; Viner et al., 2020). Accordingly, to secure the well-being of lecturers and students, sustain education activities, and ensure students' learning attainment, higher education institutions have been promptly shifted from the traditional face-to-face classroom to various online teaching and learning modes (Alsoud and Harasis, 2021; Turnbull et al., 2021). These instruction modes include both fully online and blended teaching and learning. Although many higher education institutions have widely practiced online education for years, online education is only adopted as the optimal solution when all institutions are placed in such emergency circumstances.

Investigation of current online physical education and sports training in literature has revealed distinct preparations from higher education institutions to ensure the effective practice of this new mode. Among the preparations are those related to the faculty's initiative role in delivering online classroom, which involves maintaining regular student–faculty contact, providing opportunities for student collaboration in learning, creating active learning scenarios for physical practice, giving prompt feedback on students' performance, development, and communicating high expectations to students, emphasizing time on task and respect for diverse talents and ways of learning (Beard and Konukman, 2020). In addition, the faculty needs to acquire sufficient technical knowledge for implementing an online curriculum, including operating online instruction media to meet students' needs (Centeio et al., 2021; Jumareng et al., 2021). Other preparations include an effective pedagogical instruction model, adequate infrastructure and facilities, and psychological, academic, and social support to both faculty and students (García-Calvo et al., 2014; Laar et al., 2021).

However, lack of preparation for the online instruction environment due to the sudden transformation from offline to online classes can create significant challenges in the implementation (Klapproth et al., 2020; Mishra et al., 2020; Toquero, 2020; Tria, 2020; Baker et al., 2021; Maatuk et al., 2021). Among the challenges posed by online instruction is a massive workload experienced by faculty due to changes in the teaching modes (McCann and Holt, 2009; Klapproth et al., 2020; Baker et al., 2021). Research indicate that the faculty may find online classes negative and stressful when they experience a huge workload resulting from work setting changes, and job expectations without adequate preparedness (Barrett et al., 2016; Klapproth et al., 2020; Baker et al., 2021). If it is not dealt appropriately, such severe stress and other stressful factors can lead to faculty's professional burnout whose dimensions can be exhaustion, cynicism, and low professional efficacy (Schaufeli et al., 2009; Portoghese et al., 2018).

Although research has significantly contributed to the literature on faculty stress, burnout insights, and effects on physical education and sports training (Kania et al., 2009; Barrett et al., 2016; Carson et al., 2019), few have investigated burnout in online and blended physical education instruction and sports training. In the current Vietnamese context of physical education and sports training, especially in online teaching and learning of this field, little evidence indicates that sufficient research exploring stress and burnout in online instruction has been conducted. Thus, we sought to investigate factors contributing to the burnout state of professional trainers who were engaged in fully online and blended instruction classrooms in physical education and sports training in Vietnam.

LITERATURE REVIEW

Online Instruction and Blended Learning

Since its first usage in 1995, when the web-course tool (WebCT) was viewed as the first Learning Management System (LMS), online learning and teaching have been interchangeably used in different terms of distance education, e-learning, blended learning, online education, or online courses (Conrad, 2006; Scagnoli, 2009; Miller et al., 2016; Singh and Thurman, 2019). According to Singh and Thurman (2019), online teaching and learning at that time were simply uploading text and pdf files using the LMS. Later, although different higher education institutions have tremendously adopted online teaching, the primary purpose of online education was to overcome the challenges of students who could not attend conventional classes or to widen the sources of income of the institutions (Barajas and Owen, 2000; Guri-Rosenblit, 2005). Online teaching and learning were initially conceptualized as distance education, with the incorporation of the components of time and geographic distance, to refer to different efforts of delivering instructions using electronic media to involve teachers and students who are in different physical locations (Moore, 1990; Moore et al., 2011). Later, to emphasize the technological aspects of learning and teaching, distance education was interchangeably used as e-learning which is believed to be a technological evolution of distance learning or distance education and portrayed as "the use of electronic media for a variety of learning purposes that range from add-on functions in conventional classrooms to full substitution for the face-to-face meetings by online encounters" (Guri-Rosenblit, 2005, p. 469). Over time, the two terms of e-learning and online education have been substituted and viewed as ways of bridging space between teachers and students through the use of web-based technologies (Ryan et al., 2016; Lee, 2017), which is similar to those conceptualized by Moore et al. (2011). Perceiving e-learning as an educational process, Jereb and Šmitek (2006) further clarify that e-learning or online instruction needs to involve information and communication technologies (ICTs) to facilitate both synchronous and asynchronous teaching and learning activities. Recently, the term, blended instruction or blended learning has been used as a learning method

that integrates traditional face-to-face learning with web-based or computer-assisted online learning classrooms to achieve educational goals (Feng, 2018). Taking advantage of both traditional face-to-face instruction and technological advances in an online classroom, blended instruction is believed to enhance teaching and learning effectiveness and bring benefits to students since it facilitates flexible learning, creates greater student learning engagement, and improves students' self-regulated learning (Schunk and Zimmerman, 2013; Li et al., 2020; Shim and Lee, 2020).

Whilst the adoption of online instruction has been strongly advocated by many researchers due to its strengths of providing flexibility in educational access, effort reduction, time, and cost-saving, it is still debated for creating significant challenges to some higher education institutions that are not well prepared with adequate infrastructures for online instruction practice (Chang et al., 2015; Alsoud and Harasis, 2021; Maatuk et al., 2021). In physical education and sports training, these challenges become critically severe for both faculty and students to deal with. In this traditionally marginalized subject (Richards et al., 2018), it is challenging for the faculty to convey the values and objectives of the sports and demonstration of physical movements in online classes. As Laar et al. (2021) clarify, these values and objectives include setting sports protocols and keeping oneself healthy, which can be done only through sports activities. Students who are engaged in online classes have had limited opportunities to participate in sports activities effectively and inadequate access to sports equipment at home, which inevitably restricts the students' learning objective attainment and their underperformance in sports competition (Laar et al., 2021). Other challenges in an online instruction environment include insufficient infrastructures for online delivery, lack of opportunities for demonstration and performing of professional physical movements, lack of real communication between faculty and students, the vast workload to faculty, learner motivation, and participation in online learning (Deming et al., 2015; Limone and Toto, 2018; Antonia and Pierpaolo, 2019; Jeong and So, 2020). All these challenges may create pressure and stress on faculty in physical education and sports training where sufficient attention has not been paid to by educational reforms in the practice of online instruction (Zheng et al., 2021). According to Maslach et al. (2001), such pressure and severe stress initiated from work may lead to burnout among faculty.

The Three Formative Dimensions of Burnout

Burnout was initially defined as "a syndrome of emotional exhaustion and cynicism" that occurs when an individual experiences inclusive exhaustion from work (Maslach and Jackson, 1981, p. 99). According to Zhu et al.(2018, p. 2), burnout is "a dysfunctional response to chronic emotional and interpersonal stressors at work" that one encounters when enduring an overload of stress. Three dimensions of construct burnout include exhaustion, cynicism, and professional efficacy (Maslach and Jackson, 1981). Exhaustion is described as feelings of chronic fatigue, lack of emotional energy, and emotional

exhaustion in work. Cynicism is characterized by the trainers' detached and distant attitudes toward their colleagues, students, and parents, as well as their lack of interest and commitment to the institution (Schaufeli and Buunk, 2003). Low professional efficacy, the final dimension, as described by Brouwers and Tomic (2000), refers to a person's feelings when he or she is not competent in completing assigned tasks or performing particular assignments.

Burnout Among Sports and Professional Trainers of Physical Education

Numerous studies have been undertaken to explore attributes of burnout among physical education and sports trainers. It is reported from these studies when compared with other academic-related professions, physical education, and sports training seem to create more stress and burnout in professional trainers due to their highly demanding context of training (Hendrix et al., 2000; Kania et al., 2009; Lundkvist et al., 2014; Mazerolle et al., 2018; Sas-Nowosielski et al., 2018). For example, in a study investigating stressors causing perceived stress and burnout among 118 professional trainers at a university, Hendrix et al. (2000) discovered that hardiness, social support, and training issues are significant predictors of perceived stress resulting in emotional exhaustion and a sense of personal incompetent performance accomplishment which are two critical dimensions of burnout among trainers. Similarly, Kania et al. (2009) underline that imbalance between training resources and increasing demands leads to severe emotional exhaustion and a sense of incompetent performance accomplishment among trainers. Specifically, when an imbalance between demands and resources occurs, the trainers may negatively affect their trainees or tend to self-evaluate themselves due to the perception of failure. While supporting that emotional exhaustion and personal performance accomplishment are two critical factors leading to burnout among trainers, Lundkvist et al. (2014) clarify that these factors are caused by different elements related to the distinct context of physical education and sports training, including training settings, trainers' interrelationship with trainees, their performance competence and experience in sports training, and their performance results.

While many studies investigate stress and burnout of professional trainers in physical education and sports training, little evidence shows that sufficient research has been undertaken to explore this issue, especially causes of burnout among trainers involved in fully online and blended instruction. Additionally, previous research about professional trainers' burnout in physical education and sports training indicate several inherent limitations related to research perspectives and methodology. First, most of the studies usually investigated professional trainers as general participants as those studies were conducted in other academic areas, disconnecting the professional trainers from the social-cultural and historical background from which the burnout was grounded. The authors believe that human psychological issues, such as stress and burnout need to be treated and investigated with "a multi-dimensional and systemic approach" in which all essential

psychological drives and undercurrents of power, culture, and history that shape and evolve the participants' practices should be critically analyzed (Foot, 2014, p. 329); otherwise, the issues will be only examined at face values. When investigating causes of distress or burnout experienced by professional trainers, some studies viewed professional trainers as passive participants rather than as unique individuals who are strongly impacted by a broad framework of systemic changes in which all related forces, such as society, communities, or families, need to be considered (Hanley et al., 2020), with which the authors disagree from ecological and humanistic perspectives in education.

Considering the above limitations of previous studies, we proposed that burnout of professional trainers involved a fully online and blended physical education, so sports instruction classrooms needs to be looked at in ecology, which closely connects the professional trainers to all related motives and forces of training and non-training communities, resources, demands, and families. We believe that each trainer's social-cultural and historical context needs to be examined carefully and that trainers should be viewed as proactive recipients who are actively decisive in their own training process and burnout prevention. What antecedents and why professional trainers develop the syndromes of burnout need to be investigated in a broad framework of the social, cultural, historical, and pedagogical systems rather than in discrete dimensions.

Theoretical and Analytical Frameworks
Online Learning and Burnout
Although the advantages of online lessons have been confirmed by extended literature (Dumford and Miller, 2018; Davis et al., 2019), further investigation on physical education, online instruction, and instructors' burnout during COVID-19 are still to be conducted. It is generally believed that extensive exposure to technology can cause unwanted effects on the mental well-being of the users. In terms of working, it has been discovered that the use of communication technology can encourage work distractions which may explain how it can also contribute to a rise in work-related burnout as well as a decline in work engagement of employees (Ter Hoeven et al., 2016). During the pandemic, when telecommunication has become the main channel of instruction, teachers, and academic staff further suffered from existing problems, such as prolonged use of smart devices after working hours, an excessive amount of screen time, or e-mail overuse (Estévez-Mujica and Quintane, 2018; Mheidly et al., 2020), all of which possibly led to a higher level of burnout in an online classroom. Additionally, some studies have suggested the major risks of COVID-19 on teachers' burnout. For example, Sánchez-Pujalte et al. (2021) have investigated the levels of burnout among teachers amidst COVID-19 and discovered that most of the participants were severely affected by burnout. Similarly, in their longitudinal national study, Sokal et al. (2020) indicated that Canadian teachers generally experienced high rates of exhaustion and cynicism over the first three months of the pandemic when they had to resort to online teaching. However, the connection between burnout and online teaching has not been fully established in former studies (Sokal et al., 2020; Sánchez-Pujalte et al., 2021). Previously, Hogan and McKnight

(2007) have suggested that some reasons for teachers' burnout, such as online teaching experience and overall teaching load, should be further explored in future studies. There has also been limited research on the influences of online learning during the pandemic on physical education and sports training. To conclude, despite the confirmed effectiveness of online practical classes in physical education (Yu and Jee, 2021), it remains questionable how online instruction in physical education and sports training can affect trainers' burnout during COVID-19.

Blended Learning and Burnout
Blended learning has been well established and might be considered as an ideal approach for the future education of various disciplines like nursing, dentistry, and math (Magtibay et al., 2017; Ndlovu and Mostert, 2018; Nijakowski et al., 2021). For instance, Ndlovu and Mostert (2018) concluded in their study that through synchronous and asynchronous dialogues with peers and facilitators, Moodle, a blended teaching tool, may allow in-service teachers to experience social, cognitive, and instructional presences. Likewise, Magtibay et al. (2017) and Nijakowski et al. (2021) have referred to blended learning as a favorable model to decrease burnout and increase efficiency in learning, respectively. However, with the outbreak of COVID-19, there should be some reconsideration on the influences of blended learning on physical education and sports training. The reason is that physical education and sports training may be characterized by distinct features like the inclusion of every student, including those with disabilities, in high-quality courses or the chances for students to exercise self-monitoring physical activities in regular courses (Centers for Disease Control and Prevention, 2015). Blended learning during COVID-19 can, at the same time, pose more challenges to the trainers, who are possibly experiencing a high level of burnout and technostress due to the pandemic (Panisoara et al., 2020). As trainers can be exposed to more workload as well as are more likely to get infected with the coronavirus, it may be possible that blended learning, which involves both face-to-face and online instructions, can lead to negative effects on the trainers' overall wellbeing. The current study proposes that blended learning in the context of COVID-19 can significantly influence trainers' burnout.

- As mentioned above, in sports training, the relationship between the mode of teaching and burnout has not been fully investigated. In the particular Vietnamese context of physical education and sports training, whether blended and fully online modes of teaching create different levels of professional burnout over an extended period is still open to question. Also, it is still inconclusive about what specific factors may contribute to burnout in each mode. Therefore, in addition to investigating factors that caused burnout among sports trainers who were involved in fully and blended instruction classrooms, this study aimed to examine the different levels of burnout among the target participants. Specifically, the study focused on exploring the following two main research questions: In which mode of teaching did professional sports trainers feel more burned out, fully online or blended classes?

Which factors caused the differences in professional trainers' burnout levels between fully online and blended classrooms in physical education and sports training?

To answer the first question, we compared the levels of professional burnout of trainers who were in charge of the fully online classes and those who taught blended classes at the beginning, in the middle, and at the end of the course. Regarding the second question, we examined the factors that caused the differences in the three dimensions of academic burnout, including exhaustion, cynicism, and low-performance efficacy, using the cultural-historical activity theory framework as an analytical framework. Overall, we proposed the following conceptual framework (see **Figure 1**), which were tested in this study.

The Cultural-Historical Activity Theory

From the humanistic education perspective, educational institutions play a critical role in supporting the development of an educational environment, which in turn facilitates the complete growth of an individual (Winter, 2018). Advocates of humanistic psychology also believe that all humans are unique and that all individuals have equal potentials to grow constructively, play their roles, and make interventions within the world (Hanley et al., 2020). The role of institutions is to provide all individuals with conveniences to support the development of their emotional well-being so that they can perform their roles well. Aligning to the humanistic education perspectives, especially the psychological movements, the ecological advocates of individuals' emotional well-being in educational settings emphasize that individuals need to be viewed within the social, cultural, and political contexts that they inhibit and make interventions in (Perrett, 2006 cited in Hanley et al., 2020).

The multi-dimensions of culture, history, and power are further underscored in the cultural-historical activity theory (CHAT) which proposes that all organisms should be considered and explored in relation to the constant changes and the increasingly complicated interactions that constitute the organisms (Stetsenko and Arievitch, 2004; Foot, 2014). To clarify, since humans inhabit in a community that is strongly impacted by its culture, everything individuals do will be shaped by the cultural values of their community. Further, since cultures are embedded in histories and evolved over time, analysis of the actions and practices of humans needs to be done with reference to the historical context in which their actions are taken place. The core value of the CHAT model is that as an activity constantly grows through collective actions over time, an analysis of complicated practices of professional work needs to be done in such a way of grasping the entire nature of the work, both at the particular time of investigation and over time, and not just considering it as discrete or separate components (Foot, 2014). In view of the humanistic and ecological perspectives in education, this study adopted the CHAT framework by Engeström (1987), which includes six components contributing to human activity, including subject, object, mediating artifacts, community, rules, divisions of labor, and outcome, to give insights into how social and cultural components contributed to teaching and learning. In the qualitative part, the authors applied this framework as a guideline for inquiry and discussion among trainers about their burnout.

Figure 2 describes the six components of CHAT model adapted from Engeström (1987). Specifically, a subject is an individual or a group of professional trainers whose burnout syndrome is in the focal analysis. In online instruction classrooms, objects refer to online lessons delivered both synchronously and asynchronously. Mediating artifacts include external and internal tools and guides which are used to enable and facilitate thetraining and learning of students. They also refer to devices used in online instruction, including computers, digital applications and technologies, and training platforms. Likewise, the rules are described as policies, protocols, or norms stemming from the institution or community and the cultural, economic, and political context in which the interactions between the trainers and students are taken place. Rules regulate how the instructional process is undertaken and how the trainers interact with colleagues and students in the academic communities and in other non-academic communities. The division of labor in the activity system describes what types of actions each stakeholder engaged in the instructional process will do, what role they need to perform, and what relevant tools they may use in relation to the object. Understanding the division of labor requires the investigation of "socio-historical power structures and patterns of relations both within the community and between a community and the larger culture/society of which it is part" (Foot, 2014, p. 333). Noticeably, as Engeström (1987) clarifies, pivotal impacts among the constituents constructing the everyday activity of one person needs to be considered as collectives, rather than individuals, in relation to other people and institutions as well as with other non-academic contexts. Thus, an analysis of the activity should be done with reference to a process as a whole, rather than a sequence of distinct actions (Foot, 2014). From a humanistic and ecological viewpoint, we hoped to investigate each professional trainer as a unique individual who is subject to different contexts and adversities, listening to their stories of how they struggle with distress and burnout every day and understanding how they constantly make an effort to sustain instruction despite their limited resources for this innovative teaching and learning mode used in physical education and sports in Vietnam. Thus, this CHAT framework is to be used in the focus group interview as an orientation for the participant to discuss.

METHODOLOGY

Rationale for the Method Choice

This study was grounded on pragmatic epistemology and postpositive ontology. In particular, we adopted the triangulation design validating the quantitative model suggested by Creswell (2012). In this study, we hoped that qualitative data collected from the focus-group interview would first triangulate the results of the quantitative data. Besides, the qualitative data collected from the focus group interview would validate the

FIGURE 1 | The conceptual framework presents a potential relationship between the mode of teaching and professional burnout in physical education and sports training.

FIGURE 2 | Model of instruction activities in the online classroom [adapted from Engeström (1987)].
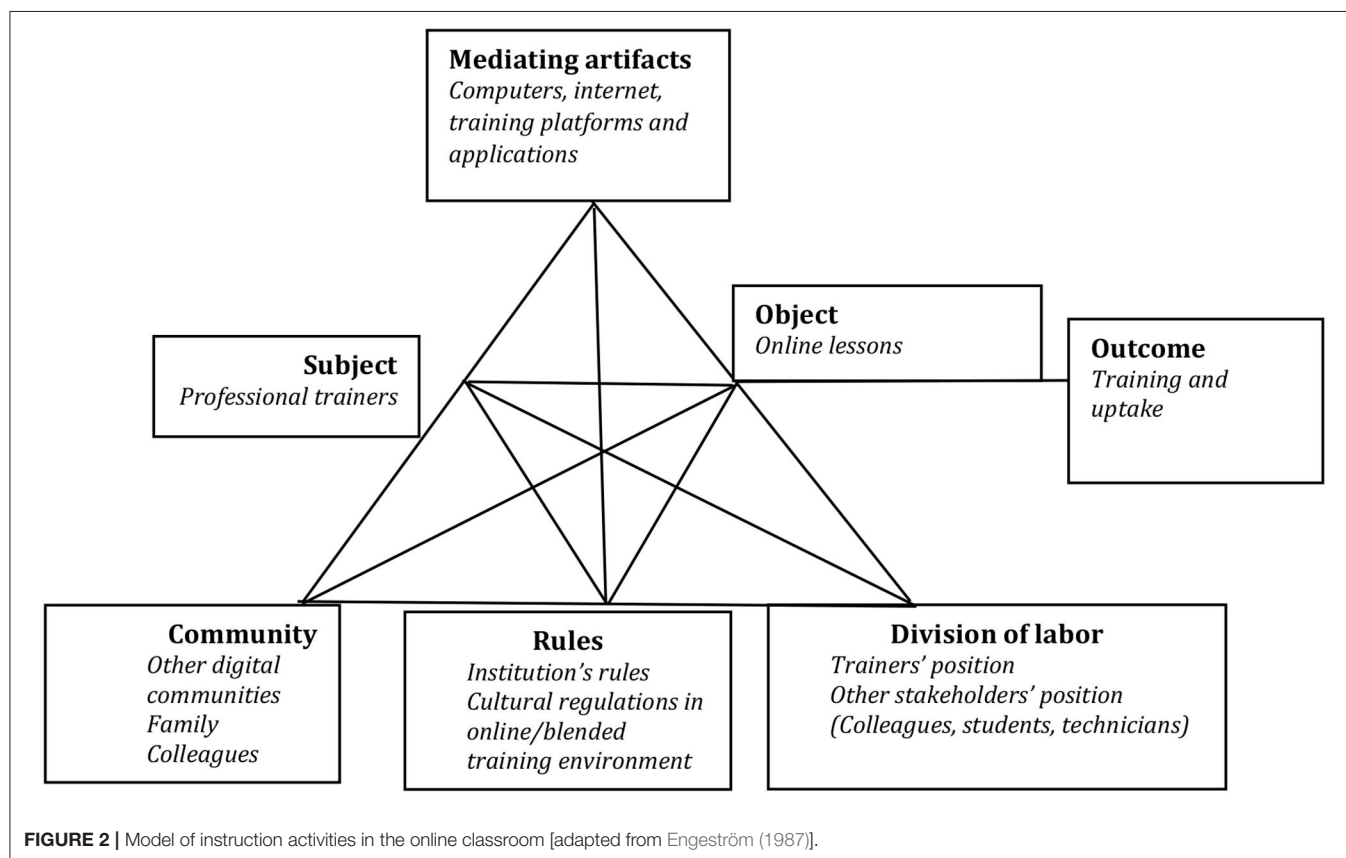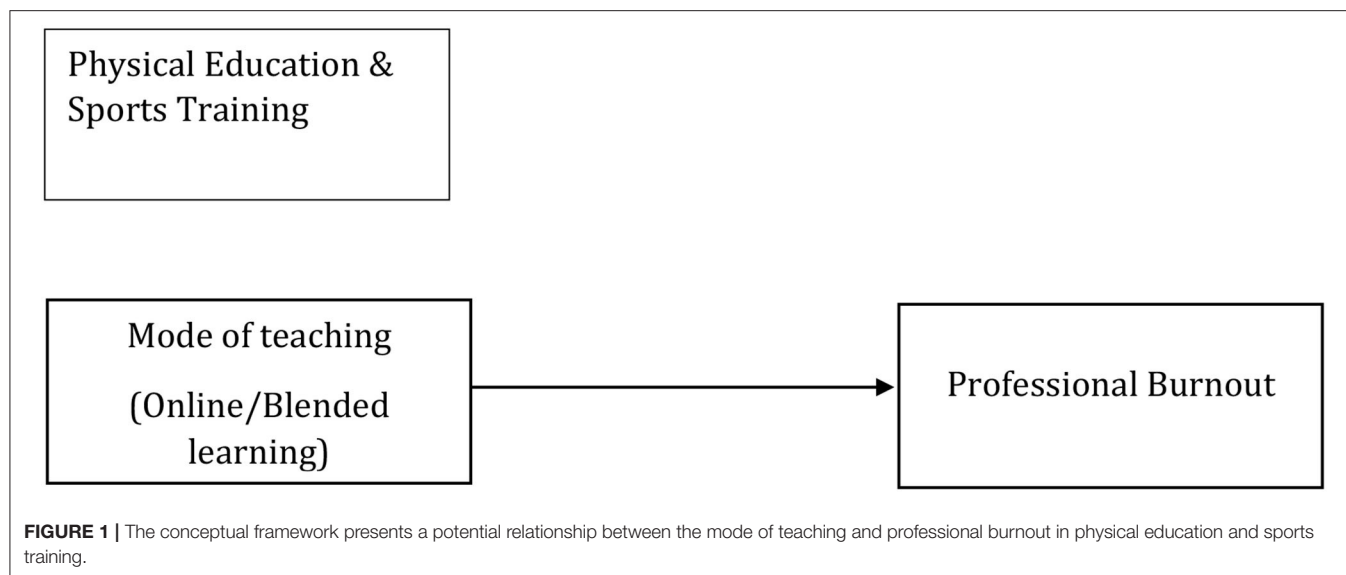
quantitative data, thus allowing us to provide with more in-depth interpretation and justification (**Figure 3**).

Participants

The study recruited 60 personal gym trainers from different professional training centers in Vietnam who agreed to join the experimental period of 3 months. There were 62% male trainers

and 38% female trainers who took part in the course. Thirty trainers had already had more than 10 -years of experience while 20 of them had had about 5–9 years working in the training sector, and 10 of them had had <4 years of experience. All the trainers recruited for the research had been already trained in cycling, yoga, general health improvement, body fits, aerobics, and boxing. Unfortunately, none of them had

FIGURE 3 | Research design model.
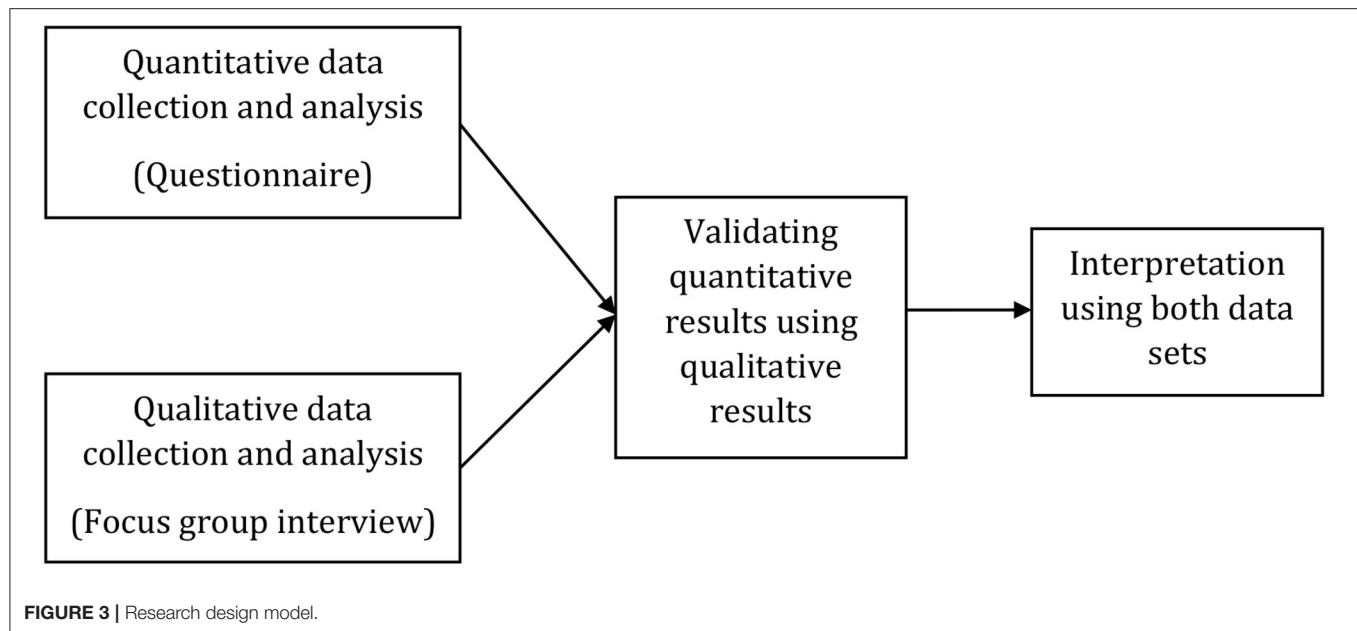
had experience in training and teaching online before as there is a very limited number of sports courses conducted online in Vietnam.

Sampling Techniques

In this study, two sampling procedures, including simple random sampling and stratified sampling, were subsequently implemented to select the participants for the experiment and the focus-group interview, respectively. Before the experiment, the study participants, who were also the survey respondents, were employed using simple random sampling. Sixty sports trainers ($N = 60$) out of 123 trainers of a gym center chain were randomly selected and divided into two classes ($n1 = n2 = 30$). The simple random sampling method allowed us to select individuals from the sample pool so that each sample registered an equal likelihood of being drawn (Creswell, 2012). Regarding the qualitative data collection, we applied the stratified sampling to recruit participants for the focus-group interview. Through personal exchanges and sharing, as well as in-class observation, we could classify familiarity and digital literacy into tentative levels. This was also accompanied by the self-reported digital-efficacy assessment form that the centers had already conducted at the beginning of the implementation of online and blended teaching. Consequently, three groups of trainers with different levels of digital self-efficacy, including high, middle, and low, were formed. In each mode of teaching, one trainer in each efficacy level was randomly chosen for the interview. This process can reduce the effects of the gaps in digital efficacy on the interpretation of burnout results (Betoret, 2006; Pellerone, 2021).

A Brief Description of the Two Modes of Teaching

Both blended learning and fully online courses offer the same syllabus for fitness courses which involves basic cardio exercises,

yoga exercises, boxing, and aerobics exercises (refer to **Table A1**). The fully online courses offered 100% of the lessons during the entire course; that is, the synchronous sessions were conducted *via* Zoom, and the asynchronous VR and 3D videos of how to work out at home were uploaded to the training management system (TMS) of the gym center chain. The trainees were quite familiar with Zoom and TMS, as Vietnam had experienced two lockdowns and shut-downs due to the surge of the COVID-19 cases. In comparison, the blended program allocated half of the course for the trainers to meet their trainees in practical face-to-face sessions while also uploading the virtual reality (VR) and online three-dimensional (3D) videos for asynchronous lessons. While all the courses followed a training syllabus, all the trainers were required to plan and modify all their instructional content of the synchronous sessions in accordance with the strengths and weaknesses of the trainees in their own classes. In total, the course comprised 60 h and lasted for 2 months. On the other hand, all the VR and 3D lessons were pre-made so that the trainers did not need to prepare these sessions by themselves. However, they had to monitor and assess the trainees' participation, time-on-task, and performance when the trainees self-studied these VR and 3D lessons in the asynchronous sessions as well.

Research Instruments
Questionnaire

The scale was adapted from the teacher's burnout inventory (Maslach et al., 1986); however, sports trainers may have different characteristics in comparison to teachers, in general. The questionnaire employed in this study contained 20 reflective items and was divided into three parts. The first eight questions assess the dimension of burnout, which is trainers' exhaustion. The second dimension was assessed using the eight questions. The final part contained the last four questions. The trainers were asked to choose one of

the six options on a Likert scale, from (0) "never" to (6) "always." Since most sports trainers were not fluent in English, the researchers translated the English version of the questionnaire into Vietnamese. The translation of the questionnaire into the mother tongue of the participants was expected to increase data reliability and return rate (Thomas, 2013).

Regarding the pilot test of this questionnaire, the researchers applied the Delphi methods to collect the expert panel's consent. A group of 10 experts was asked to assess quality and the translated version of the pilot questionnaire. The experts' panel reviewed and commented on the questionnaire in three rounds anonymously and independently. After each round of questionnaire revision, the authors asked the panel to provide their consent score for each item using the Delphi consensus method, using the following formula:

$$Formula : QD = \frac{Inter-quartile\ range}{2}$$
$$= \frac{(Q_3 - Q_1)}{2}$$

The quartile deviation (QD) was 0.3, which was lower than 0.5. This result means that it has received a high level of consensus. Also, the median was 4.3, which is higher than 4.0 and thus signifies high importance (Ab Latif et al., 2017). After that, 20 other voluntary trainers were recruited to answer the pilot questionnaire online. The responses were collected, and Cronbach's alpha was used to examine these responses. It yielded high values for the three dimensions of the burnout scale (from α = 0.839 to α = 0.945). The results confirmed that this survey was reliable enough to administer to the experimental groups. The taxonomy of the finalized questionnaire is presented in **Table A2**.

Focus-Group Interview

Focus groups could supplement more traditional types of individual interviews or observation when we wanted to collect qualitative data and triangulate the results of the quantitative data (Cohen et al., 2007). Different from the individual interviews, when individuals answered a set of predetermined questions, in this focus group interview, we provided the participants with the following two questions:

- What factors caused burnout in each mode of teaching?
- What were the major reasons for the differences in the burnout levels between the two classes, if any?

First of all, we provided the participants with the CHAT framework and helped them specify stakeholders and artifacts of the society that potentially affected their teaching and training process. Having been provided with the CHAT model, the participants were asked to discuss among themselves to figure out the similarity and differences in their opinions toward the two questions. We acted as facilitators who supported the participants in their whole-group sharing process. The facilitators also actively helped the group dig deeper into several aspects of the CHAT framework when most participants believed that their burnout state might come from the same underlying causes.

Procedures

After getting consent from the board of research ethics, we sent out the participant recruitment document to the trainers who were about to be the potential participants for the study. After identifying the participants, we informed them about the research aims, purposes, procedures, benefits, and risks and asked for their written consent to participate anonymously in the research. The participants then received official initial training to familiarize themselves with the syllabus and the teaching platforms in 2 weeks. Then, there was a one-week washout period when the participants prepared their own lesson plans. This washout period was also necessary to avoid the sequencing effects of the training on the participants' burnout state. The participants then started to teach their own courses. Each course accommodated ~10–15 trainees. The participants underwent three tests to measure their burnout. The first test occurred right before they began their online teaching and blended classes, while the second and the third test took place in the middle and at the end of their teaching.

In the qualitative stage, when the participants agreed to join, a one-hour focus group interview was set up. Before the interview, the interviewers had discussed the meaning of *burnout* with participants to reach a mutual understanding of the term used in the interview. The entire focus-group interview was recorded, transcribed, and closely examined with the accompaniment of the interviewer's note. This note described in detail the reaction of the group when talking about different stakeholders and artifacts, as well as the percentage of the participants agreeing on each idea discussed. After that, all the data were critically analyzed and sent back to the participants for reconfirmation and feedback.

Data Collection and Analysis

The quantitative data were analyzed using SPSS 20, while the qualitative data were analyzed with Nvivo 20. For the quantitative data, the burnout levels of trainers were compared thrice before they began teaching, in the middle of, and at the end of their course using independent sample *t*-tests. Regarding the qualitative data, based on the frequency analysis and auto-coding function of NVivo 20, we discussed and finalized the main themes in several meetings to ensure no important theme was left out and sent them to the participants for their reconfirmation. This stage was repeated until all the participants agreed that no critical idea was missing from the research.

RESULTS AND FINDINGS

Quantitative Results

The trainers of the two modes of teaching were required to take burnout tests thrice, in the beginning, in the middle, and at the end of their course. In general, the level of burnout among fully online trainers witnessed an upward trend throughout the whole period. In sharp contrast, the burnout levels of trainers decreased gradually in the blended teaching course.

Table 1 shows that the fully online group was not significantly different from blended courses in terms of trainers' burnout ($p = 0.594$) in Stage 1. The two group means in this stage indicate that the average burnout scores for the fully online group

($M = 3.40$) is not lower than the score of the blended training ($M = 3.30$). The difference between the means pointed on a 6-point scale is 0.10. The effect size, d, is ∼0.14, which is a small effect size. However, in Stage 2, fully online group ($M = 4.06$) differed significantly from blended group ($M = 2.77$) in the level of trainer's burnout ($p = 0.000$) with a large effect size ($d = 2.54$). Similarly, fully online was also significantly different from the blended course in Stage 3 ($p = 0.000$). Inspection of the means of the two groups illustrates that the difference between the means is 2.93 in Stage 3, and the mean for fully online (M = 5.05) is higher than for the blended group (M = 2.12). The effect size, d, is ∼4.15.

Qualitative Findings

An in-depth analysis of the discussion of the focus group was revealed; while the trainers in the fully online classes felt burnout due to four main aspects of the CHAT framework, the burnout syndromes of their counterparts who taught the blended classrooms comes from only three aspects (see **Table 2**).

The Beginning of the Course

Trainers of both teaching modes experienced initial exhaustion due to unfamiliarity with the new teaching methods. All the six trainers confirmed that they felt "scared, overwhelmed, and overly anxious" (T1) as they had not experienced any online sports training course before. Two of the trainers even reported that they "doubted [their] professional efficacy" as teaching sports online was "impossible" (T4, T5). Another trainer also reported that, as most trainers were "not familiar with computer-based and internet-based teaching," they were afraid that "everything can get out of control" (T4).

Trainers from the fully online classes also reported other issues that led to their burnout, including technical facility and internet connection. As the fully online trainers had to teach the trainees *via* Zoom, they "spent more time checking the connection than real training." Thus, at the very beginning of the course, "most of our source of stressors that led to our burnout is due to technical issues" (T2). Digital lesson planning is also a part of the problem of the fully online trainers. Most of them had to "burn the midnight oil" because the lesson plan to teach an online course "is fundamentally different and requires much more incorporation of pedagogical techniques and digital tools" (T1, T2).

On the other hand, the burnout state of the trainers of blended classes stemmed mainly from the pressure of the community. Although the Vietnamese government has declared the "new normal" state, which allows everyone to get back to their daily offline work after being fully vaccinated, there are still concerns from the families of the trainers. Trainers, T4 and T5 reported that their families usually showed overt concerns. More noticeably, one trainer also frequently experienced insomnia which was a reflective sign of burnout. In particular, she explained, "fear of the trainees' safety is haunting my sleep. Teaching the yoga part requires constant attention to the trainees' practices or else detrimental accident may occur" (T3). T6 claimed that although the VR and 3D lessons were predetermined, he was asked to review all the materials to ensure that all the activities were safe enough for the trainees to practice

at home, which was "exhausting" as the trainers had to "watch hundreds of clips at a time." This unnamed extra workload also made some trainers experience "constant migraine and dried eyes."

In the Middle of the Course

The content and word frequency analysis revealed that while all three trainers (T1, T2, and T3) in the fully online courses felt even more exhausted and more cynical, the blended trainers felt more "balanced" as they became more "familiar with the new approach." Fully online trainers reported that they experienced more sources of burnout as the course continued. Since interaction is minimal in the fully online classes, all three trainers even felt more inefficacious. T3 reported that "as the trainees often remained silent and some even turned off their webcam during the training session, I felt hopeless. Teaching sports online 100% does not make sense. The more we taught them, the more invaluable I felt." Likewise, T2 confirms that the trainees became more and more demotivated as they trained at home. She started to feel cynical toward the job, stating that "Well, I stop caring about whether they reply or not. After all, this is just an emergency solution. They have the recordings to revise after our synchronous session." The trainers even felt they were overburdened as the gym centers did not offer adequate support. T1 and T2 complained in the focus group interview that "the customer service team was not effective."

In contrast, the trainers in the blended classes claimed that the only reason for their burnout state was just because some of the trainers and trainees suffered from the post-COVID syndromes. T5 reported that "I think everything is getting ok as all of us have familiarized ourselves with the program." T4 also added that "blended learning still allows us to meet the trainees and provide the necessary support. I think the bone between the trainers and the trainees became more tightened, which made us happier and less burned out." However, all the trainees reported that they experience some "burnout moments," especially when some trainers become "slower and get fatigued faster due to the post-COVID syndromes." Also, they claimed that the trainees were also demotivated at times when "they felt like they lose their confidence and energy as they had before COVID. They were not as durable as […]" (T6). Noticeably, all the trainers of the blended class noted that their burnout in the middle of the course was not the result of the nature of blended teaching but was the consequence of the pandemic.

At the End of the Course

From the focus group interview, the fully online trainers agreed that they were still susceptible to various factors that lead to their constant high burnout level. All the problems with technology, demotivated trainees, lack of interactions, lack of regulations, and increased workloads remained to constitute the burnout state of all fully online trainers. All the three trainers (T1, T2, and T3) said that they "could not stand the pressure of online teaching any longer" as there was very "limited interaction," and "many trainees" practiced their exercises "imprecisely," which was likely to result in "injuries" in the long run. Also, many trainees also give feedback to the trainers that they would like to

TABLE 1 | Comparison of blended learning and online learning on teachers' burnout over the three stages ($n1 = 30$ and $n2 = 30$).

Variable	M	SD	T	df	p	d
Stage 1			0.53	53.37	0.594	0.14
Blended	3.30	0.60				
Fully online	3.40	0.82				
Stage 2			9.90	58	0.000	2.54
Blended	2.77	0.45				
Fully Online	4.06	0.55				
Stage 3			16.09	35.34	0.000	4.15
Blended	2.12	0.95				
Fully online	5.05	0.31				

"drop out" because the online lesson was not "effective in helping [them] to keep fit." Also, over-exposure to the screen worsened the exhaustion and created some health issues for the trainers. Moreover, T1 said that "sports trainers are not used to teaching online like teachers of other subjects. They are supposed to move around and support people to get away from their sedentary lifestyle. So, at the end of the course, I totally felt cynical and lost all my efficacy." Similarly, trainer T3 believed that a fully online training could not yield significant benefits for the trainees, and thus it lowered his sense of professional efficacy.

In sharp contrast, the trainers who participated in the blended classrooms reported that they were relieved from their burnout state at the end of the course. T4 said that "After all, I am used to blended teaching, and this saved us a lot of time reciting the theory." Likewise, trainer T5 agreed that "blended learning is effective although I was reluctant to use it at first. I did not feel burned out at the end of the course anymore." In particular, T6 endorsed that blended learning can "reduce the workload" and as they can meet the trainees offline, "interaction is guaranteed to meet our requirement." The only remaining factors that the trainers found to have "some limited effects that may make us feel burnout" were concerns about unanticipated accidents that may occur to the trainees when they practice at home using VR and 3D videos. However, all the three trainees agreed that "we did not worry much about that because after all, we had checked all the contents so that we expected that severe injuries are hardly likely to happen."

DISCUSSION

Professional Trainer Burnout in Fully Online Classrooms vs. Burnout in Blended Classroom

The quantitative data present that, although both modes of teachers created a high burnout level for trainers at first, fully online teaching increased trainers' burnout when blended teaching witnessed a gradual downward trend as time passed by. This result is confirmed by the qualitative data which further clarify that professional sports trainers of the fully online mode constantly experienced various dimensions of the CHAT framework. Their counterparts, who participated in the blended

mode, in contrast, could curb many different sources of burnout as they entered the latter stage of their teaching. It can be implied that the nature of fully online training is not suitable for physical education and sports training as it exacerbates trainers' burnout, which is different from studies in other subjects claiming that online learning and teaching are as effective as the face-to-face mode of training. While other studies highlight that fully online instruction classrooms are as effective and successful as traditional face-to-face ones (Beard and Konukman, 2020; Kwon, 2020; Centeio et al., 2021), this study reveals that such success and effectiveness of a fully online classroom cannot be found in physical education and sports training area.

Significantly, while the high level of burnout among professional trainers who were involved in fully online instruction classrooms as compared to those of blended ones indicates the ineffectiveness of fully online classroom delivery, it also implies a lack of preparation and support provided for the professional trainers in implementing this important instruction mode. In addition to sufficient infrastructures and facilities equipped for online teaching, the preparation for trainers needs to include appropriate trainings in online teaching for trainers and updates of the current syllabi to be suitable for online instruction practice (as the syllabi used for the traditional face-to-face instruction cannot be used for fully online instruction classrooms). An implication from the findings of this study about the ineffectiveness of fully online instruction is consistent with those from previous studies that lack preparation and support in online instruction which can create challenges and stress to professional trainers, and that such challenges and stress would create burnout among trainers (Klapproth et al., 2020; Mishra et al., 2020; Toquero, 2020; Tria, 2020; Baker et al., 2021; Maatuk et al., 2021). As the trainers who were involved in blended instruction classroom had 50% of their instruction length meeting face-to-face with the trainees, they had the opportunity to explain to students the details of the lessons or made up the instructional parts which could not be delivered during the online instruction sessions. In short, they had the opportunity of resolving and releasing their stress created by online instruction sessions. However, for professional trainers who were involved in fully online instruction classrooms, they were not able to find such valuable opportunity during their instruction. Obviously, trainers of fully online instruction classrooms would suffer and

TABLE 2 | Overarching themes and coding instructions.

Mode of sport training delivery	Corresponding dimension of the CHAT framework	Sub-theme and coding instructions	Sample of coded text
Fully online	Mediating artifacts	Technical facility and internet connection	Delivering online sports training requires me to turn on my webcam continuously. However, the internet connection in Vietnam is not stable at peak hours. I had to struggle a lot to reconnect whenever Zoom kicked me out.
		Over-exposure to the screen	I was physically and mentally drained after spending the whole day in front of the computer planning my lesson and teaching. I had never trained sports online before, so I had to adapt all of my lesson plans. Sports are meant to make people more active, rather than gluing them to the screen and ruin their physical and mental health. I find my job meaningless when I have to go against my mojo with this mode of teaching.
		Unfamiliarity with online teaching	I am overwhelmed as I have to prepare too many things so that I can deliver an online lesson. I am scared at times when I have to talk to the screen.
	Outcome	Demotivated trainees	I started to feel cynical toward this job after a month. Teaching sports online is not motivating enough for the trainees to get beyond their limits.
	Rules and regulations	Online regulations	Unlike face-to-face lessons, we cannot impose regulations to force students to train more strenuously. After all, they are at their home. Thus, I don't think the trainers like us are efficient enough in this kind of classroom.
	Division of labor	Increased workload	I have never taught a sports course online before, and thus, I had to work overnight on my lesson plans. I felt like all my sources of life had been squeezed out.
		Institutional roles	Except for the delivery of the course, I did not notice any support from the center. They should have joined and helped us take care of the trainees in the online class. I doubt the effectiveness of the customer service team.
	Community	Lack of interaction	I am under constant tension when nobody replies to me in the online training session. The whole lesson started to be "mentally damaging" because both the trainers and the trainees should have contributed equally to the content
Blended	Objects	Concerns about unanticipated accidents	Well, it is a little bit daunting at first. I have never taught a blended class before. I could not sleep well and usually felt tired after having a nightmare about my trainees getting injured as they practiced at home.
	Division of labor	Unnamed extra work	Although the lesson was readily made, we had specifically asked to watch all the VR and 3D lessons first to see if they were safe enough, which also took us extra days to review. It was exhausting watching 100 of clips at a time
	Community	Coronavirus anxiety	I always felt tense whenever I had to teach the face-to-face practical sessions. It is very dangerous. Sometimes my family asked me to quit teaching because they were afraid, although we have all been vaccinated.
	Outcome	Post-COVID syndromes	Many trainees had post-COVID syndromes, so they were not fine enough. I felt worthless as I could not help them at times.
	Subject	Post-COVID syndromes	I myself had been infected with COVID-19. I was exhausted when I had to come and teach in person.

struggle with the recurrent challenges in online instruction. Such challenges and stress combined with lack of support from the leadership of the institute and inadequate supplies and equipment for online instruction would certainly lead to burnout and increase their burnout level.

Additionally, although the level of burnout among professional trainers who were involved in blended instruction classrooms is much lower than those who were involved in fully online classes, such level of burnout again confirmed that online instruction is not suitable for practice in physical education and sports training unless it is made up with face-to-face instruction sessions where trainers can have real communication with the trainees to back up what was missed or unable to deliver in the online instruction sessions, especially those related to the distinct

values of physical education and sports training. Our study is in line with other studies which stated that blended learning and teaching might be suitable for various disciplines like nursing, dentistry, and math (Magtibay et al., 2017; Ndlovu and Mostert, 2018; Nijakowski et al., 2021). As our studies is amongst the few studies investigating trainers' burnout in a blended mode of physical education and sports training, it is possible that this mode can be implemented with more consideration of the next advancement in sports and physical training, especially with the aid of VR and 3D technologies, to reduce the unnecessary pressure and stress that the trainers suffer every day.

Underlying Reasons Causing the Discrepancies in Burnout levels Between Two Modes of Training Delivery

There are different sources yielding burnout among professional trainers of fully online and blended instruction classrooms (Maslach et al., 2001; Kania et al., 2009; Mazerolle et al., 2018). Whilst burnout among trainers of fully online classrooms resulted from the teaching methods and techniques, burnout in blended classrooms was produced as an outcome of post-COVID syndromes.

Specifically, analysis of quantitative data indicates that professional trainers experienced severe exhaustion and cynicism as well as having a low sense of performance accomplishment when they were delivering fully online lessons. These findings are further confirmed by qualitative data analysis which states that fully online instruction in physical education and sports brings about critical challenges and risks to both trainers and trainees. These challenges, as clarified by the trainers participating in this study, include demotivation in both teaching and learning due to lack of adequate resources for demonstrating distinct values and objectives of the lessons and restriction to trainers in giving feedback on the trainees' demonstration of physical movements. Additionally, according to these trainers, limitations in having adequate sports equipment for physical demonstration may lead to unexpected accidents in practice among trainees. In the traditional face-to-face classrooms, these accidents are certainly fixed and resolved with the trainers' help; however, such practice may not be completely done when the trainers and trainees are engaged in fully online instruction classrooms. In the meantime, when one of the distinct values and objectives of physical education and sports training is to raise trainees' awareness and develop their sports protocols which can be done through their frequent participation in sporting and physical activities (Laar et al., 2021); findings from the study show that these values and objectives seem not to be achieved due to trainees' lack of frequent participation in physical and sports activities. One of the obvious reasons is that the trainees are not well equipped with adequate supplies and facilities for their frequent sporting and physical practice at home and that some trainees may not have sufficient space at home for their practice. Such constraints not only demotivate the trainees in having frequent physical and sporting practices but also disable them to keep themselves healthy for effective sporting performance.

Analysis of both quantitative and qualitative data also reveals that long-term fully online instruction delivery produces inferior interaction between trainers and trainees, a huge workload for trainers, and a lack of confidence among trainers in physical education and sports training practice. These findings are similar to those of other studies examining the challenges in online instruction in physical education and sports training, as proposed by Deming et al. (2015), Limone and Toto (2018), Antonia and Pierpaolo (2019), and Jeong and So (2020). Overall, all professional trainers of this study believe that physical education and sports is a particular distinct subject area whose crucial objective is to keep the trainees healthy lifelong through the frequent and adequate practice of physical and sports activities, which can be done only in face-to-face instruction classrooms, rather than having both trainers and trainees fully stick themselves to the computer screen *via* Zoom platform.

Findings from this study indicate that when both trainers and trainees are not well-prepared for the fully online instruction lessons, especially essential conditions for delivering online lessons have not been provided, it is advised that fully online instruction classrooms in physical education and sports should be limited in Vietnam to avoid unexpected challenges and unnecessary pressure to trainers as well as risks in physical practice to trainees.

In sharp contrast, results of data analyses show that burnout among trainers of blended instruction classrooms was caused by post-Covid syndromes rather than those related to the conditions for delivering the online lessons. The trainers of blended instruction classrooms reported that their physical actions seem to be slower than before their infection of the Covid-19. Such post-Covid syndromes, such as frequent tiredness, depression, impaired sleep quality, breathlessness, muscle pain, and loss of concentration on work, were really burdened and disabled the trainers from having effective physical movements and demonstrations to students. Coming back to work after recovery from the infection, some trainers explained that they still faced severe fatigue and post-covid syndromes, which made them fail to return to their normal lives as well as to have the lessons delivered as effectively and efficiently as before. Significantly, although Vietnam has announced the new normal state across the country, results of qualitative data analysis indicate that the trainers of blended instruction classrooms face high pressure from their families objecting them to get back to face-to-face instruction due to the anxiety that they will get re-infected by the virus; this seems to be the most challenging source that causes burnout syndromes among trainers in addition to the post-COVID syndromes that they have suffered and struggled with. However, later during the course delivery, it is indicated by the findings of the study that the trainers' burnout syndromes become less severe when all of them are vaccinated with the third shot of vaccines.

Additionally, since physical education and sports training are traditionally instructed in face-to-face mode, most trainers were not completely confident in using digital technologies to enhance their instructional quality. However, as the trainers involved in blended instruction classrooms had 50% of their course length involved with face-to-face instruction, and the rest of the time

was saved for online lessons, as they indicated; such allocation of time, course structure development, and use of blended instruction platforms helped increase their confidence levels in teaching. Significantly, the trainers of blended classrooms emphasized that the utilization of both VR and 3D has critically reduced them from the pressure of delivering theoretical instruction to trainees since the trainees can review the target theories with the tutorials and applications provided. This view has been extensively confirmed by many studies about using VR and 3D in education, especially in physical education and sports training (Cook et al., 2019; Calabuig-Moreno et al., 2020; Liu and Pu, 2021). For example, Calabuig-Moreno et al. (2020) emphasize that the use of such technologies as VRand 3D helps reinforce trainees' learning and increase their motivation in learning motor skills and techniques while developing their offensive skills in physical and sporting practice. Similarly, Liu and Pu (2021) further stress that while 3D animation technologies enable trainers to simulate difficult and new physical movements and demonstrate a tactical process to students, they can help make up for weaknesses that can be found in the traditional face-to-face classroom instruction to improve the instructional quality. Particularly, 3D technologies can provide panoramic viewing angles and visual demonstration of the physical actions and movements while enhancing the controllability over the demonstration of technical action that is challenging for trainees to observe in the traditional demonstration methods (Liu and Pu, 2021).

Implications and Recommendations for Future Research

Findings from this study about professional trainers engaged in fully online and blended classroom instruction suggest the widespread integration of digital technologies in physical education and sports training in Vietnam while confirming the effectiveness of blended instruction in this particular area. The findings also imply that institutions need to have better preparations for the trainers to involve in this new and meaningful platform of teaching. In addition to having adequate resources for online instruction implementation, including sufficient supplies and facilities, for the trainers to effectively perform distinct values of the subject areas, these preparations include providing adequate medical and psychological consultancy services for both trainers and their families about how to protect the impact of COVID on people's mental and physical health and updated regulations from the government on safely getting back to new normal lives. Additionally, to enhance the online instructional quality, it is essential to have adequate trainings on using and creating VR/3D technologies in classrooms for physical education and sports trainers so that they can fully utilize the strengths of advanced technologies in improving the effectiveness and quality of the current teaching.

Whilst our study confirms the strengths of the CHAT framework in exploring factors causing burnout among professional trainers who were involved in both fully and blended online instruction classroom, especially in identifying the three dimensions of burnout (i.e., exhaustion, cynicism, and low professional efficacy), the study still had two limitations. First, although the study was conducted with the participations of professional trainers coming from different gym centers, these gym centers belong to one gym center chain which may not fully represent the variety of professional trainer population across the country where there are different gyms center chains in operation. Furthermore, this study was carried out right after the pandemic outbreak in Vietnam when the professional trainers were not provided with appropriate preparations for the online instruction, including trainings on using and creating VR and 3D technologies in teaching and learning. It is possible that the results of the study may be different when professional trainers are well prepared for online instruction and supported by their leaders and administrators in the implementation of this new mode.

With the above two limitations, the authors would suggest that future research which explore professional trainers' burnout from online instruction in Vietnam need to take into consideration the diversity of the target participant group so that they can fully represent the large population of the participants. This will help strengthen the results of the research results and generalize the results for future practice purposes. Additionally, since burnout usually comes from anxiety and stress which results from exhaustion and cynicism when one person experiences an overload at work (Maslach and Jackson, 1981; Zhu et al., 2018), the burnout level may be increased when the study is conducted in the crisis time of the pandemic in which the trainers are exhausted not only from the workload but also from related inconvenient conditions of teaching and learning. Therefore, we would strongly recommend that future research in professional trainers' burnout in online teaching and learning in Vietnam need to critically take into account the time for conducting the research to ensure that the results of the research are not affected by surrounding factors which are not really related to online instruction, such as the trainers' family or personal affairs and inconveniences caused by the emergency or crisis circumstances, unless the objectives of the research are aimed at exploring issues in the particular context of these circumstances.

CONCLUSION

Although online teaching and blended learning has long been available in many other disciplines, they have not received adequate scholarly attention in the field of physical education and sports training, especially in Vietnam. While many gym centers in Vietnam were struggling due to shut-down and lock-down policies, some of them started to consider the possibility of technology-based training courses. However, one of the most important aspects to consider when teaching sports online is whether trainers are susceptible to moments of burnout. This study was conducted in a gym center chain that has been offering two special formats of blended courses and fully online courses utilizing VR and 3D technologies. This study confirms that trainers are more burned out in fully online classes than in the blended mode of teaching. Also, when the nature of a fully online class is incompatible with long-term training, trainers' burnout in the blended class only resulted from post-COVID syndromes

and from some initial fear, unfamiliarity, and reduced gradually. Thus, this study expects blended learning may be developed as a long-term option of sports training delivery that helps reduce trainers' burnout and discourage the implementation of fully online courses due to its trend to increase trainers' burnout stage. Findings from this study has significantly contributed to the literature of physical education and sports trainers' burnout due to online instruction classes, which is still scarce in Vietnam. With the current limitations in this study, including the possible negative effects that COVID-19 may have on the trainee's burnout and the lack of participant diversity, we suggest that more research investigating stress and burnout of professional trainers in physical education and sports training in Vietnam should be conducted in normal time. Also, it is important to take into consideration the participants of different age and social group for conducting further research.

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by HQT Education Ltd.'s Board of Research Ethics. The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

All authors listed have made a substantial, direct, and intellectual contribution to the work and approved it for publication.

REFERENCES

Ab Latif, R., Dahlan, A., Ab Mulud, Z., and Mat Nor, M. Z. (2017). The Delphi technique as a method to obtain consensus in health care education research. *Educ. Med. J.* 9, 89–102. doi: 10.21315/eimj2017.9.3.10

Alsoud, A. R., and Harasis, A. A. (2021). The impact of COVID-19 pandemic on student's e-learning experience in Jordan. *J. Theoret. Appl. Electr. Commerce Res.* 16, 1404–1414. doi: 10.3390/jtaer16050079

Antonia, G. T., and Pierpaolo, L. (2019). Research on a massive open online course (MOOC): a rapid evidence assessment of online courses in physical education and sport. *J. Phys. Educ. Sport* 19, 2328–2333. doi: 10.7752/jpes.2019.s6352

Baker, C., Peele, H., Daniels, M., Saybe, M., Whalen, K., and Overstreet, S. (2021). The experience of COVID-19 and its impact on teachers' mental health, coping, and teaching. *School Psychol. Rev.* 2020:1855473. doi: 10.1080/2372966X.2020.1855473

Barajas, M., and Owen, M. (2000). Implementing virtual learning environments: looking for holistic approach. *Educ. Technol. Soc.* 3, 39–53.

Barrett, J., Eason, C. M., Lazar, R., and Mazerolle, S. M. (2016). Personality traits and burnout among athletic trainers employed in the collegiate setting. *J. Athletic Training*, 51, 454–459. doi: 10.4085/1062-6050-51.7.08

Beard, J., and Konukman, F. (2020). Teaching online physical education: the art of connection in the digital classroom. *J. Phys. Educ. Recr. Dance* 91, 49–51. doi: 10.1080/07303084.2020.1785772

Betoret, F. D. (2006). Stressors, self-efficacy, coping resources, and burnout among secondary school teachers in Spain. *Educ. Psychol.* 26, 519–539. doi: 10.1080/01443410500342492

Brouwers, A., and Tomic, W. (2000). A longitudinal study of teacher burnout and perceived self-efficacy in classroom management. *Teach. Teacher Educ.* 16, 239–253. doi: 10.1016/S0742-051X(99)00057-8

Calabuig-Moreno, F., González-Serrano, M. H., Fombona, J., and García-Tascón, M. (2020). A general bibliometric analysis with a focus on virtual and augmented reality. *Sustainability* 12, 1–23. doi: 10.3390/su12072728

Carson, F., Malakellis, M., Walsh, J., Main, L. C., and Kremer, P. (2019). Examining the mental well-being of Australian sport coaches. *Int. J. Environ. Res. Public Health* 16:4601. doi: 10.3390/ijerph16234601

Centeio, E., Mercier, K., Garn, A., Erwin, H., Marttinen, R., and Foley, J. (2021). The success and struggles of physical education teachers while teaching online during the COVID-19 pandemic. *J. Teach. Phys. Educ.* 40, 667–673. doi: 10.1123/jtpe.2020-0295

Centers for Disease Control and Prevention (2015). High quality physical education. Available online at: https://www.cdc.gov/healthyschools/pecat/highquality.htm (accessed May 30, 2022).

Chang, R. I., Hung, Y. H., and Lin, C. F. (2015). Survey of learning experiences and influence of learning style preferences on user intentions regarding MOOC s. *Br. J. Educ. Technol.* 46, 528–541. doi: 10.1111/bjet.12275

Chinazzi, M., Davis, J. T., Ajelli, M., Gioannini, C., Litvinova, M., Merler, S., et al. (2020). The effect of travel restrictions on the spread of the 2019 novel coronavirus (COVID-19) outbreak. *Science* 368:aba9757. doi: 10.1126/science.aba9757

Cohen, L., Manion, L., and Morrison, K. (2007). "Research methods in education," in *Research Methods in Education, 6th Edn*. London: Routledge/Taylor and Francis Group. doi: 10.4324/9780203029053

Conrad, D. (2006). "E-learning and social change: an apparent contradiction," in *Perspectives on Higher Education in the Digital Age*, ed M. Beaudoin (New York, NY: Nova Science Publishers), 21–33.

Cook, M., Lischer-Katz, Z., Hall, N., Hardesty, J., Johnson, J., McDonald, R., et al. (2019). Challenges and strategies for educational virtual reality: results of an expert-led forum on 3D/VR technologies across academic institutions. *Inform. Technol. Libr.* 38, 25–48. doi: 10.6017/ital.v38i4.11075

Creswell, J. W. (2012). *Educational Research : Planning, Conducting, and Evaluating Quantitative and Qualitative Research*. London: Pearson.

Davis, N. L., Gough, M., and Taylor, L. L. (2019). Online teaching: advantages, obstacles and tools for getting it right. *J. Teach. Travel Tour.* 19, 256–263. doi: 10.1080/15313220.2019.1612313

Deming, D. J., Goldin, C., Katz, L. F., and Yuchtman, N. (2015). Can online learning bend the higher education cost curve? *Am. Econ. Rev.* 105, 496–501. doi: 10.1257/aer.p20151024

Dumford, A. D., and Miller, A. L. (2018). Online learning in higher education: exploring advantages and disadvantages for engagement. *J. Comput. High. Educ.* 30, 452–465. doi: 10.1007/s12528-018-9179-z

Engeström, Y. (1987). *Learning by Expanding: An Activity-Theorical Approach to Developmental Research*. Helsinki: Orienta-Konsultit Oy.

Estévez-Mujica, C. P., and Quintane, E. (2018). E-mail communication patterns and job burnout. *PLoS ONE* 13:e0193966. doi: 10.1371/journal.pone.0193966

Feng, S. Q. (2018). Applied research on college sports blended learning based on moodle platform. *Educ. Sci.* 18, 1077–1086. doi: 10.12738/estp.2018.5.01

Foot, K. A. (2014). Cultural-historical activity theory: exploring a theory to inform practice and research. *J. Hum. Behav. Soc. Environ.* 24, 329–347. doi: 10.1080/10911359.2013.831011

García-Calvo, T., Leo, F. M., Gonzalez-Ponce, I., Sánchez-Miguel, P. A., Mouratidis, A., and Ntoumanis, N. (2014). Perceived coach-created and peer-created motivational climates and their associations with team cohesion and athlete satisfaction: evidence from a longitudinal study. *J. Sports Sci.* 32, 1738–1750. doi: 10.1080/02640414.2014.918641

Guri-Rosenblit, S. (2005). 'Distance education' and 'e-learning': not the same thing. *High. Educ.* 49, 467–493. doi: 10.1007/s10734-004-0040-0

Hanley, T., Winter, L. A., and Burrell, K. (2020). Supporting emotional well-being in schools in the context of austerity: an ecologically informed humanistic perspective. *Br. J. Educ. Psychol.* 90, 1–18. doi: 10.1111/bjep.12275

Hendrix, A. E., Acevedo, E. O., and Hebert, E. (2000). An examination of stress and burnout in certified athletic trainers at division I-A universities. *J. Athletic Training* 35, 139–144.

Hogan, R. L., and McKnight, M. A. (2007). Exploring burnout among university online instructors: an initial investigation. *Internet High. Educ.* 10, 117–124. doi: 10.1016/j.iheduc.2007.03.001

Jeong, H., and So, W. (2020). Difficulties of online physical education classes in middle and high school and an efficient operation plan to address them. *Int. J. Environ. Res. Public Health* 17, 1–12. doi: 10.3390/ijerph17197279

Jereb, E., and Šmitek, B. (2006). Applying multimedia instruction in e-learning. *Innov. Educ. Teach. Int.* 43, 15–27. doi: 10.1080/14703290500467335

Jumareng, H., Setiawan, E., Patah, I. A., Aryani, M., Asmuddin, and Gani, R. A. (2021). Online learning and platforms favored in physical education class during Covid-19 era: exploring student's perceptions. *Int. J. Hum. Mov. Sports Sci.* 9, 11–18. doi: 10.13189/saj.2021.090102

Kania, M. L., Meyer, B. B., and Ebersole, K. T. (2009). Personal and environmental characteristics predicting burnout among certified athletic trainers at national collegiate athletic association institutions. *J. Athletic Training* 44, 58–66. doi: 10.4085/1062-6050-44.1.58

Klapproth, F., Federkeil, L., Heinschke, F., and Jungmann, T. (2020). Teachers' experiences of stress and their coping strategies during COVID-19 induced distance teaching. *J. Pedagogical Res.* 4, 444–452. doi: 10.33902/JPR.2020062805

Kwon, E. H. (2020). Review of online learning in physical education teacher education (PETE) program. *J. Phys. Educ. Sport* 20, 3560–3568. doi: 10.7752/jpes.2020.06480

Laar, R. A., Ashraf, M. A., Ning, J., Ji, P., Fang, P., Yu, T., et al. (2021). Performance, health, and psychological challenges faced by students of physical education in online learning during COVID-19 epidemic: a qualitative study in China. *Healthcare* 9, 2–17. doi: 10.3390/healthcare9081030

Lee, K. (2017). Rethinking the accessibility of online higher education: a historical review. *Internet High. Educ.* 33, 15–23. doi: 10.1016/j.iheduc.2017.01.001

Li, X., Yang, Y., Chu, S. K. W., Zainuddin, Z., and Zhang, Y. (2020). Applying blended synchronous teaching and learning for flexible learning in higher education: an action research study at a university in Hong Kong. *Asia Pacific J. Educ.* doi: 10.1080/02188791.2020.1766417

Limone, P., and Toto, G. A. (2018). The psychological constructs and dimensions applied to sports performance: a change of theoretical paradigms. *J. Phys. Educ. Sport* 18:2034. doi: 10.7752/jpes.2018.s5302

Liu, D., and Pu, B. (2021). Research on physical education and training based on the theoretical teaching of computer three-dimensional animation technology. *J. Phys.* 1744, 2–6. doi: 10.1088/1742-6596/1744/3/032052

Lundkvist, E., Stenling, A., Gustafsson, H., and Hassmén, P. (2014). How to measure coach burnout: an evaluation of three burnout measures. *Measur. Phys. Educ. Exerc. Sci.* 18, 209–226. doi: 10.1080/1091367X.2014.925455

Maatuk, A., Elberkawi, E., Aljawarneh, S., Rashaideh, H., and Alharbi, H. (2021). The COVID-19 pandemic and e-learning: challenges and opportunities from the perspective of students and instructors. *J. Comput. High. Educ.* 34, 21–38. doi: 10.1007/s12528-021-09274-2

Magtibay, D. L., Chesak, S. S., Coughlin, K., and Sood, A. (2017). Decreasing stress and burnout in nurses: efficacy of blended learning with stress management and resilience training program. *J. Nurs. Admin.* 47:501. doi: 10.1097/NNA.0000000000000501

Maslach, C., and Jackson, S. E. (1981). The measurement of experienced burnout. *J. Org. Behav.* 2, 99–113. doi: 10.1002/job.4030020205

Maslach, C., Jackson, S. E., and Schwab, R. L. (1986). *Maslach Burnout Inventory: Manual; With a Special Supplement "Burnout in Education"; [MBI]*. Palo Alto, CA: Consulting Psychologists Press.

Maslach, C., Schaufeli, W., and Leiter, M. P. (2001). Job burnout. *Ann. Rev. Psychol.* 52, 397–422. doi: 10.1146/annurev.psych.52.1.397

Mazerolle, S. M., Eason, C. M., and Goodman, A. (2018). An examination of relationships among resiliency, hardiness, affectivity, and work-life balance in collegiate athletic trainers. *J. Athletic Training* 53, 78–795. doi: 10.4085/1062-6050-311-17

McCann, J., and Holt, R. (2009). An exploration of burnout among online university professors. *J. Dist. Educ.* 23, 97–110.

Mheidly, N., Fares, M. Y., and Fares, J. (2020). Coping with stress and burnout associated with telecommunication and online learning. *Front. Public Health* 8:574969. doi: 10.3389/fpubh.2020.574969

Miller, A., Topper, A. M., and Richardson, S. (2016). *Suggestions for Improving IPEDS Distance Education Data Collection. (NPEC 2017). U.S. Department of Education*. Washington, DC: National Postsecondary Education Cooperative. Available online at: https://nces.ed.gov/ipeds/pdf/NPEC/data/NPEC_Paper_IPEDS_Distance_Education_2017.pdf (accessed May 30, 2022).

Mishra, L., Gupta, T., and Shree, A. (2020). Online teaching-learning in higher education during lockdown period of covid-19 pandemic. *Int. J. Educ. Res. Open.* 2020:100012. doi: 10.1016/j.ijedro.2020.100012

Moore, L. J., Dickson-Deane, C., and Galyen, K. (2011). E-Learning, online learning, and distance learning environments: are they the same? *Internet High. Educ.* 14, 129–135. doi: 10.1016/j.iheduc.2010.10.001

Moore, M. G. (1990). *Background and Overview of Contemporary American Distance Education. Contemporary Issues in American Distance Education*. New York, NY: Pergamon Press, xii–xxvi.

Ndlovu, M. C., and Mostert, I. (2018). Teacher perceptions of Moodle and throughput in a blended learning programme for in-service secondary school mathematics teachers. *Africa Educ. Rev.* 15, 131–151. doi: 10.1080/18146627.2016.1241667

Nijakowski, K., Lehmann, A., Zdrojewski, J., Nowak, M., and Surdacka, A. (2021). The effectiveness of the blended learning in conservative dentistry with endodontics on the basis of the survey among 4th-year students during the COVID-19 pandemic. *Int. J. Environ. Res. Public Health* 18:94555. doi: 10.3390/ijerph18094555

Novikov, P. (2020). Impact of COVID-19 emergency transition to online learning on international students' perceptions of educational process at Russian university. *J. Soc. Stud. Educ. Res.* 11, 270–302.

Panisoara, I. O., Lazar, I., Panisoara, G., Chirca, R., and Ursu, A. S. (2020). Motivation and continuance intention towards online instruction among teachers during the COVID-19 pandemic: the mediating effect of burnout and technostress. *Int. J. Environ. Res. Public Health* 17:18002. doi: 10.3390/ijerph17218002

Pellerone, M. (2021). Self-perceived instructional competence, self-efficacy and burnout during the covid-19 pandemic: a study of a group of italian school teachers. *Eur. J. Investig. Health Psychol. Educ.* 11, 496–512. doi: 10.3390/ejihpe11020035

Portoghese, I., Leiter, M., Maslach, C., Galletta, M., Porru, F., d'Aloja, E., et al. (2018). Measuring burnout among university students: factorial validity, invariance, and latent profiles of the italian version of the Maslach Burnout Inventory Student Survey (MBI-SS). *Front. Psychol.* 9:2105. doi: 10.3389/fpsyg.2018.02105

Richards, K. A. R., Gaudreault, K. L., Starck, J. R., and Woods, A. M. (2018). Physical education teachers' perceptions of perceived mattering and marginalization. *Phys. Educ. Sport Pedagogy* 23, 445–459. doi: 10.1080/17408989.2018.1455820

Ryan, S., Kaufman, J., Greenhouse, J., She, R., and Shi, J. (2016). The effectiveness of blended online learning courses at the community college level. *Commun. Coll. J. Res. Practice* 40, 285–298. doi: 10.1080/10668926.2015.1044584

Sánchez-Pujalte, L., Mateu, D. N., Etchezahar, E., and Gómez Yepes, T. (2021). Teachers' burnout during COVID-19 pandemic in Spain: trait emotional intelligence and socioemotional competencies. *Sustainability* 13:137259. doi: 10.3390/su13137259

Sas-Nowosielski, K., Szostak, W., and Herman, E. (2018). What makes coaches burnout in their job? prevalence and correlates of coaches' burnout in Poland. *Int. J. Sports Sci. Coach.* 2018, 1–9. doi: 10.1177/1747954118788539

Scagnoli, N. (2009). A review of online learning and its evolution in Latin America. *Policy Fut. Educ.* 7:555. doi: 10.2304/pfie.2009.7.5.555

Schaufeli, W., Leiter, M., and Maslach, C. (2009). Burnout: 35 years of research and practice. *Career Dev. Int.* 14:13620430910966406. doi: 10.1108/13620430910966406

Schaufeli, W. B., and Buunk, B. P. (2003). "Burnout: an overview of 25 years of research and theorizing," in *The Handbook of Work and Health Psychology*, eds M. J. Winnubst, and C. L. Cooper (Chichester: Wiley), 383–425. doi: 10.1002/0470013400.ch19

Schunk, D. H., and Zimmerman, B. J. (2013). "Self-regulation and learning," in *Handbook of Psychology*, eds W. M. Reynolds, G. E. Miller, and I. B. Weiner (John Wiley & Sons, Inc)

Shim, T., and Lee, S. (2020). College students' experience of emergency remote teaching due to COVID-19. *Child. Youth Serv. Rev.* 119, 1–7. doi: 10.1016/j.childyouth.2020.105578

Singh, V., and Thurman, A. (2019). How many ways can we define online learning? A systematic literature review of definitions of online learning (1988-2018). *Am. J. Dist. Educ.* 33, 289–306. doi: 10.1080/08923647.2019.1663082

Sokal, L., Trudel, L. E., and Babb, J. (2020). Canadian teachers' attitudes toward change, efficacy, and burnout during the COVID-19 pandemic. *Int. J. Educ. Res. Open* 1:100016. doi: 10.1016/j.ijedro.2020.100016

Stetsenko, A., and Arievitch, I. M. (2004). The self in cultural-historical activity theory: reclaiming the unity of social and individual dimensions of human development. *Theory Psychol.* 14, 475–503. doi: 10.1177/0959354304044921

Ter Hoeven, C. L., van Zoonen, W., and Fonner, K. L. (2016). The practical paradox of technology: the influence of communication technology use on employee burnout and engagement. *Commun. Monogr.* 83, 239–263. doi: 10.1080/03637751.2015.1133920

Thomas, G. (2013). *How to Do Your Research Project : A Guide for Students in Education and Applied Social Sciences, 2nd Edn.* Newcastle upon Tyne: SAGE.

Toquero, C. M. (2020). Challenges and opportunities for higher education amid the COVID-19 pandemic: the Philippine context. *Pedagogical Res.* 5:7947. doi: 10.29333/pr/7947

Tria, J. Z. (2020). The COVID-19 pandemic through the lens of education in the Philippines: the new normal. *Int. J. Pedagogical Dev. Lifelong Learn.* 1:ep2001. doi: 10.30935/ijpdll/8311

Turnbull, D., Chugh, R., and Luck, J. (2021). Transitioning to e-learning during the covid-19: how have higher education institutions responded to the challenge?. *Educ. Inform. Technol.* 23, 605–616. doi: 10.1007/s10639-021-10633-w

Viner, R. M., Russell, S. J., Croker, H., Packer, J., Ward, J., Stansfield, C., et al. (2020). School closure and management practices during coronavirus outbreaks including COVID-19: a rapid systematic review. *Lancet Child Adolesc. Health* 4, 397–404. doi: 10.1016/S2352-4642(20)30095-X

Winter, L. A. (2018). Relational equality in education: what, how, and why? *Oxford Rev. Educ.* 44, 338–352. doi: 10.1080/03054985.2017.1391761

Yu, J., and Jee, Y. (2021). Analysis of online classes in physical education during the COVID-19 pandemic. *Educ. Sci.* 11:3. doi: 10.3390/educsci11010003

Zheng, W., Ma, Y.-Y., and Lin, H.-L. (2021). Research on blended learning in physical education during the COVID-19 pandemic: a case study of Chinese students. *SAGE Open* 2021, 1–12. doi: 10.1177/21582440211058196

Zhu, M., Liu,Q., Fu,Y., Yang,T., Zhang, X., and Shi, J. (2018). The relationship between teacher self-concept, teacher efficacy and burnout. *Teachers Teaching.* 24, 788–801. doi: 10.1080/13540602.2018.1483913

APPENDIX

TABLE A1 | Sample course training syllabus—month 1.

Unit	Main topic	Type
1	Course overview, learning guidelines, and monitoring intensity	Synchronous
2	Dynamic warm-up patterns	Synchronous
3	SMART goal development for daily self-training	Asynchronous
4	Basic moves in Hatha yoga (Part 1)	Synchronous
5	Sport nutrient for muscle building and weight loss	Asynchronous
6	Cardio exercise with weight and jumping ropes	Synchronous
7	The meaning of *Om* in Yoga practice and breathing control	Asynchronous
8	Jamba Basic Dance—Cardio exercise	Synchronous
9	Injury prevention and first aid for an at-home workout	Asynchronous
10	Basic moves in Hatha yoga (Part 2)	Synchronous

This Table provides a sample syllabus for one-month training. In the first month, the trainers provide six synchronous training sessions while the four asynchronous training sessions are available on the training management system (TMS), which the trainees can access after each synchronous lesson. The same syllabus was applied for both types of training courses, namely fully online and blended. The syllabus of the first month is aimed to provide trainees with the fundamentals of workout exercises, basic nutrient and sports knowledge, and injury prevention.

TABLE A2 | Trainer's burnout taxonomy.

Dimension	Item number
Exhaustion	I.1 – I.8
Cynicism	II.1-II.8
low professional efficacy	III.1-III.4

As mentioned above, the questionnaire examines three dimensions of lecturer burnout, including exhaustion, cynicism, and low professional efficacy. Also, the questionnaire is based on the study by Maslach et al. (1986) and is adapted to fit the context of sports trainers using Delphi's methods and pilot test.

Students' Perception and Performance Regarding Structured Query Language Through Online and Face-to-Face Learning

Amir Elalouf[1]*, Arik Edelman[1,2], Dafna Sever[1], Shaked Cohen[1], Reut Ovadia[1], Omer Agami[1] and Yulia Shayhet[1]

[1] *Department of Management, Bar-Ilan University, Ramat Gan, Israel,* [2] *ISRAPORT, Rishon Lezion, Israel*

This study explores the Structured Query Language (SQL) learners' perceptions in online and face-to-face learning regarding the role of the instructor, clarity in lesson delivery and understanding, and concerns about the shift in learning mode. In parallel, we evaluate the performance of online and face-to-face SQL learners in the final examination. The COVID-19 pandemic has forced educational institutes to shift their activities online. Thus, online learning has been accepted during the pandemic and gradually evolving. The literature on online and face-to-face learning has evaluated limited variables. Yet, in online and face-to-face learning, critical parameters concerning the SQL learners' perceptions about the role of instructors have not been explored. The present study surveyed the final-year students learning medium-level SQL courses at Bar-Ilan University Israel and the College of Management Academic Studies Israel. Survey questionnaires included demographic information, online learning experience, online learning sources, and ten questions about the learners' concerns of shifting, effectiveness, adequate instructions, the lecturer's clarity during instruction, clear understanding of the lesson, instructor's tools, instructor's availability, satisfactory response, learning independence, and spending extra time in online and face-to-face learning, separately. This study included 102 online learners and 95 face-to-face learners. All the online learners used Zoom and WhatsApp, and the face-to-face learners used Gmail and WhatsApp. Both online and face-to-face learners were significantly satisfied with the lecturer's performance, especially with the clarity in lecture delivery, instructor availability, and satisfactory response from the lecturer. In addition, online learners agreed upon the effective way of learning, clear understanding of the lesson, independence, and spending extra time. In contrast, face-to-face learners were more satisfied with the tools of the lecturer and dissatisfied with the dependence on the lecturer. Female students attending face-to-face learning were more concerned about the shift in the mode of learning. Further, online learners performed better in written examinations and face-to-face learners in oral examinations. Notwithstanding, advancements are still required to redesign the online learning environment for critical thinking in higher education.

Keywords: COVID-19 pandemic, face-to-face learning, online learning, SQL, students performance

INTRODUCTION

The World Health Organization (WHO) declared the coronavirus outbreak a global pandemic in March 2020 (Arora et al., 2021). The global pandemic has generated severe concerns among the education systems' stakeholders. According to a UNICEF report, more than one billion students from about 100 countries have suffered educational setbacks due to the closure of educational institutes (UNICEF, 2020). As far as the national educational systems have dealt with, COVID-19 is the greatest challenge faced to date (Yosef et al., 2021). Adverse effects of COVID-19 on education are the disruptions of learning, less access to research facilities, loss of jobs, and increased student burdens (Majeed et al., 2020). Lockdowns were imposed worldwide with the instructions of social distancing and restrictions on large social gatherings to prevent the virus's spread. Therefore, the educational system shifted from face-to-face to online learning to engage students in academic activities (Paudel, 2020). In Israel, educators expressed severe concerns about education during COVID-19. Google Scholar found about 41,000 publications with the keywords education, impact, and pandemic in Israel (Yosef et al., 2021).

In this challenging situation, information technology has lightened the way for learners to get their education through innovative learning management systems. Educators use IT solutions to teach and evaluate students' coursework. For optimal use of technology and efficient learning processes, teachers, students, and administrators worked hard to ensure the continuity of online learning (Khan et al., 2021). However, poor infrastructures such as the unavailability of the internet and inadequate digital management systems hampered online learning. Even so, adopting modern technology and improving digit skills is necessary to fulfill the educational loss (Crossley and McNamara, 2016). Previous literature has pointed out the genuine complications in subjects such as chemistry and mathematics since they demand special assistance (Bakker and Wagner, 2020; Rap et al., 2020; Waitzberg et al., 2020; Heyd-Metzuyanim et al., 2021). Poor infrastructure, awareness, planning problems, and applicable policies also complicate the aptitude for teaching scientific topics at universities in Israel (Methkal et al., 2021; Yosef et al., 2021).

Online learning is not a recent trend; it was known as distance learning back in the early 18th century. Online learning is a segment of distance learning in which internet-based synchronous and/or asynchronous education is offered. Live online sessions are offered in a synchronous form of education. While asynchronous online learning, which is more traditional than distance learning, allows students to access course materials at their own pace. In online learning, students can access real-time lectures through learning management systems and/or the recorded lectures for later viewing. In distance learning, teacher and student do not interact frontally. The innovative progress of distance learning has developed parallel to communication technology over the last 300 years (Kentnor, 2015). In contrast, face-to-face learning is synchronous and real-time learning where instructors attend a real-time physical classroom with the students. In general, online learning is entirely offered over the internet, while face-to-face learning can be combined with online learning to support the learning process effectively (Watson, 2008; Chisadza et al., 2021; Segbenya et al., 2022).

Online learning is necessary for pandemic times, but paying attention to the traditional way of learning is also essential. Undoubtedly, online learning provides students with great flexibility because they can watch the recorded lessons repeatedly. It is an unfeasible service in the traditional learning model (Khalil et al., 2020). Nonetheless, recorded classes do not allow for questions or interventions. The student watches it and performs it unilaterally, so they do not have a chance to participate in real-time. However, students can share their screens during online classes to share their mistakes in real-time for learning purposes with teachers and fellows. Although, online learning might generate a sense of feeling left out among students who are not addressed during classes. Thus, students should be given time slots to discuss their problems with the teacher (Rapanta et al., 2020). Recently, the COVID-19 pandemic forced the prompt implementation of online learning. For instance, on March 17, 2020, all the K-12 schools in the Washington State of United States and the University of Washington halted face-to-face classes and started online learning (Calhoun et al., 2020).

Online learning also depends on the nature of the course, whether it can be quickly taught or understood. Learning technology courses such as Structured Query Language (SQL) is beneficial in online learning due to lesson concentration, shared learning, and complete practice. SQL is a declarative computer language for processing data. It describes what to perform and what not to while solving the problem. In SQL, various options allow retrieving and updating the data, focusing on essence rather than technique (Halperin et al., 2013). Previously, research revealed that a deep understanding of novices' common semantic mistakes when writing SQL queries would improve teaching and learning outcomes (Ahadi et al., 2015). The SQL language independence and power make it possible to retrieve complex portions simply. The language's extraordinary productivity makes it famous among programmers and non-programmers. The SQL language is taught as a technological course in academic institutions and laboratories where students can practice the material provided by their instructors (D'Auria Stanton, 2006).

Previous studies (Yavuzarslan et al., 2019; Lai, 2020; Ribaud, 2020; Tuparov and Tuparova, 2021) have evaluated limited parameters regarding the perceptions of online and face-to-face SQL learners. Yet, essential parameters regarding the SQL learners' perceptions about the role of instructors and performance evaluation in online and face-to-face learning remain unattended. Therefore, the present study aims to evaluate and compare the perceptions of online and face-to-face SQL learners regarding the (a) concerns about the shifts in learning modes, (b) effectiveness and understanding of the SQL course, (c) learning tools used by the instructor, (d) instructor role, and (e) independence. In parallel, this study

compares and correlates the performance of online and face-to-face SQL learners.

LITERATURE REVIEW

Online learning is student-centered learning that allows students to be independent and search for additional resources to enhance their prospects. Meanwhile, face-to-face learning is teacher-centered, where students depend on their instructors. Students rely on the instructions and guidelines from the instructors (Roach and Lemasters, 2006; Gherheş et al., 2021). Students' attitudes toward interactive courses online and in-person are identical. A study of online and face-to-face learners concluded that both groups performed equally well in interactive courses. Success in face-to-face classes depends on regular attendance, whereas interactive classes hinge on completing interactive worksheets. Hence, face-to-face and online success result from curriculum structure, mode of delivery, and completion rate (Nemetz et al., 2017). Indeed, online learning is a flexible, efficient, cost-effective, and first-rate method (Bartley and Golek, 2004; Gratton-Lavoie and Stanley, 2009; Strayer University, 2020). However, the abrupt shift from face-to-face to online learning has tested the coping capacity of educational institutions and the adaptation of students and faculty (Almahasees et al., 2021). Online learning has brought an engaging way of learning that positively impacts faculty and students to overcome this health crisis.

Online learning played a substantial role during times of crisis. Thus, improving the technical infrastructure is imperative for schools, universities, and research centers (Nikdel Teymori and Fardin, 2020). A study investigating SWOT (strengths, weaknesses, opportunities, and threats) analysis of online learning suggested the requirement of information technology learning and training at the school level (Dhawan, 2020). Nevertheless, data privacy is a massive challenge in online learning despite the benefits. Therefore, faculty members and learners must receive special training on data privacy and cybersecurity (Luxatia, 2020).

The successive progress and substantial technological changes require amendments to the last decade's methodology, strategies, and education techniques in online learning (Almahasees and Jaccomard, 2020). During the lockdown, education shifted online with proper planning to reduce the impact on the learning process (Gurukkal, 2020). Online learning has benefited students at the university level since theoretical courses were conveniently taught online. Yet practical courses require face-to-face learning practices (Isaeva et al., 2020; Siripongdee et al., 2020). In this regard, technological enterprises have developed several online platforms to integrate technology into all facets of life (McLoughlin and Lee, 2010; Englund et al., 2017; Santos et al., 2019). The most frequently used interactive online platforms are Zoom, WhatsApp, WeChat Work, Teams, Skype, and DingTalk (Almahasees et al., 2021). Regarding the use of online platforms for education, a study affirmed that 66.7% of the respondents had heard about

Zoom for online learning (Adeyeye et al., 2022). Another study confirmed that 92% of the respondents knew Zoom, Microsoft Teams, and Moodle before the shift to online learning (Jehad et al., 2020). Thus, students' awareness and knowledge of online platforms and tools positively impact the development of constructive skills in online learners (Baanqud et al., 2020).

Previous literature has reported positive perceptions and opinions of both students and teachers about online learning (Seok et al., 2010; Kulal and Nayak, 2020). Although teachers and students were comfortable with online learning for theoretical subjects, they had concerns for practical subjects (Kinney et al., 2012; Beck and Blumer, 2016). In this regard, a study reported the efforts of learners and instructors to encounter the challenges of workload, technology, compatibility, and digital competence. This study recommended hybrid education (online and face-to-face learning) for theoretical and practical courses (Adedoyin and Soykan, 2020). Previous research confirmed higher achievements (Zhang et al., 2006), improved analytical skills (Chen and Jones, 2007), academic success (Al-Qahtani and Higgins, 2013), achieving learning goals (Wilkowski et al., 2014), higher self-confidence (Kay and McKlin, 2014), and better performance (Thai et al., 2017) in online learners compared to face-to-face learners. Notably, medical students were satisfied with online learning (Al-Balas et al., 2020). In a study conducted in Malaysia, Shahzad et al. (2021) reported a substantial satisfactory correlation among online learners. In contrast, a significant satisfaction among face-to-face learners over online learners has been mentioned by Tratnik et al. (2019). The reported challenges in online learning were students' shyness to participate and a lack of social interaction. Nevertheless, students were encouraged to participate in online class activities (Pinto, 2020). In parallel, negative emotions such as anger, fear, and helplessness amongst online learners has been published by Butz et al. (2015).

Besides common factors such as learning models, teaching technology, student-teacher interaction, and course content, effective online teaching largely depends on the instructor's role (Wang et al., 2021). Various facilitation strategies and cloud computing tools successfully enhance students' understanding of course content in online learning environments, increase students' engagement, and inspire them to explore new knowledge (Martin et al., 2018, 2019; Xu et al., 2020). Multiple scaffolding strategies online can also improve students' learning outcomes (Mamun et al., 2020). Most studies investigating the role instructors play in student learning have focused on instructor performance, instructional support, and instructor innovation (Wang et al., 2021). Students' perceptions of the quality of differentiated support for learning are among the most significant components influencing their independent learning and motivation (Mamun et al., 2020). Instructors provide instructional support in online learning environments by providing clear instructions, explanations, and constructive and timely feedback using various scaffolding strategies (Martin et al., 2018; Mamun et al., 2020). Learning outcomes and satisfaction with instruction are strongly associated

with instructional support in asynchronous online courses (Yunusa and Umar, 2021).

Research on the impact of instructor innovation on student learning outcomes in online learning environments is limited. However, a preliminary study of an asynchronous online learning environment found that instructor innovation is positively related to student satisfaction (Lee, 2011). According to the literature, students' engagement and motivation can also be enhanced when appropriate e-learning strategies and skills are applied to online teaching (Xu et al., 2020). Effective online educators are essential to student success (Ali and Ahmad, 2020). Hence, teachers need to continuously acquire new skills and expertise to facilitate students' learning and improve performance (Martin et al., 2018). In addition, instructors must ensure positive interactions between learners and instructors at all levels, including learners-learners and learners-content/technology. They must also be capable of determining appropriate tasks and tests for each student due to their differences. Lastly, instructors' attitudes and mastering technology are critical for the effectiveness of e-learning and students' perceptions of e-learning environments (Wang et al., 2021).

Research on SQL courses includes a pilot study investigating the knowledge and skills of students learning introductory level SQL online and face-to-face. The study reported a significant preference of the participants for face-to-face learning. Interestingly, blended learners showed substantial performance with positive effects and improvements (Yavuzarslan et al., 2019). Another related study reported motivating learners to embrace the shift of SQL learning to online during the pandemic. Students were encouraged to participate in the SQL Challenge Game in an online class that was used to engage them in activities and improve their academic achievement. Such challenging games appealed to and helped the learners to perform better academically. Student participation in the SQL Challenge Game was high, and the game scores highly correlated with students' academic performance (Lai, 2020). A study at Brest University revealed that with the increase in students (from 35 to 119), it was challenging to teach SQL courses online to computer science students, so they had returned to classical learning. However, students' perceptions and performance were similar (Ribaud, 2020). A recent pilot study discovered higher final achievements with gamified training and assessment in online SQL learning (Tuparov and Tuparova, 2021).

METHODOLOGY

This study evaluated the acceptability and effectiveness of online or face-to-face learning from two groups of students learning the SQL course online or in-class. The paper also examined the performance of the two groups in final examinations.

Participants

This study considered final-year students of 2020 and 2021 learning medium-level SQL courses at Bar-Ilan University Israel and the College of Management Academic Studies Israel. The following participants were chosen because they were in their last year of studies and had mastered medium-level SQL courses. Additionally, the same instructor taught both groups with the same syllabus. In 2020, online classes were conducted, while in 2021, face-to-face classes.

Course

The SQL course was medium-level. The main topics in the SQL course were Entity Relationship Diagram, Basic Queries: select and from, using where, inner join, left and right joined and using group by and having with agg function, Union Query, and Sub Query: select, where, having, from.

Study Design and Questionnaire

Two questionnaires (**Supplementary Material 1**) were prepared to evaluate the perceptions of online and face-to-face learners regarding educational shift concerns, effectiveness, understanding, acceptability, and role of the instructor in SQL courses in an online and face-to-face mode of learning. **Figure 1** depicts the study design. Due to the research gap in the literature regarding these parameters, questions were derived from the related studies (Roddy et al., 2017; Van Wart et al., 2020; Almahasees et al., 2021; Zalat et al., 2021). All the questions were rewritten in a more straightforward and explicit form. The questionnaires comprised different sections, including demographic characteristics, previous online learning experience, online learning sources, and ten questions to assess various parameters for online learning and face-to-face classes. The questions were formatted on five points Likert scale from strongly agree to disagree strongly. The questions estimated the students' concerns about the shift in learning methods, effectiveness, adequate instructions, the lecturer's clarity during instruction, clear understanding of the lesson, instructor's tools, instructor's availability, satisfactory response, learning independence, and spending extra time in online learning and face-to-face learning. The final term examination results were obtained to evaluate the students' online or face-to-face learning performance. The final exam papers were divided into three sections: 20 marks objectives included multiple-choice questions, 50 marks subjective had short questions and extensive questions, and 30 marks viva (oral examination), in which the instructor asked the students different questions relevant to the subject. Viva was conducted virtually *via* Zoom in online learning and frontal in face-to-face learning.

Reliability and Validity

Two experts who examined cross-outs from both surveys validated the survey design. Some irrelevant items were omitted from the survey in response to their comments. The reliability of online and face-to-face learners' questionnaires was measured by Cronbach's alpha. The Cronbach's alpha value of both questionnaires was 0.7. The Cronbach's alpha value of responses ≥0.7 is considered acceptable (Bujar et al., 2019).

Data Collection

An online Google Survey Form was used to survey online learning. In comparison, printed questionnaires were distributed

FIGURE 1 | Study design.
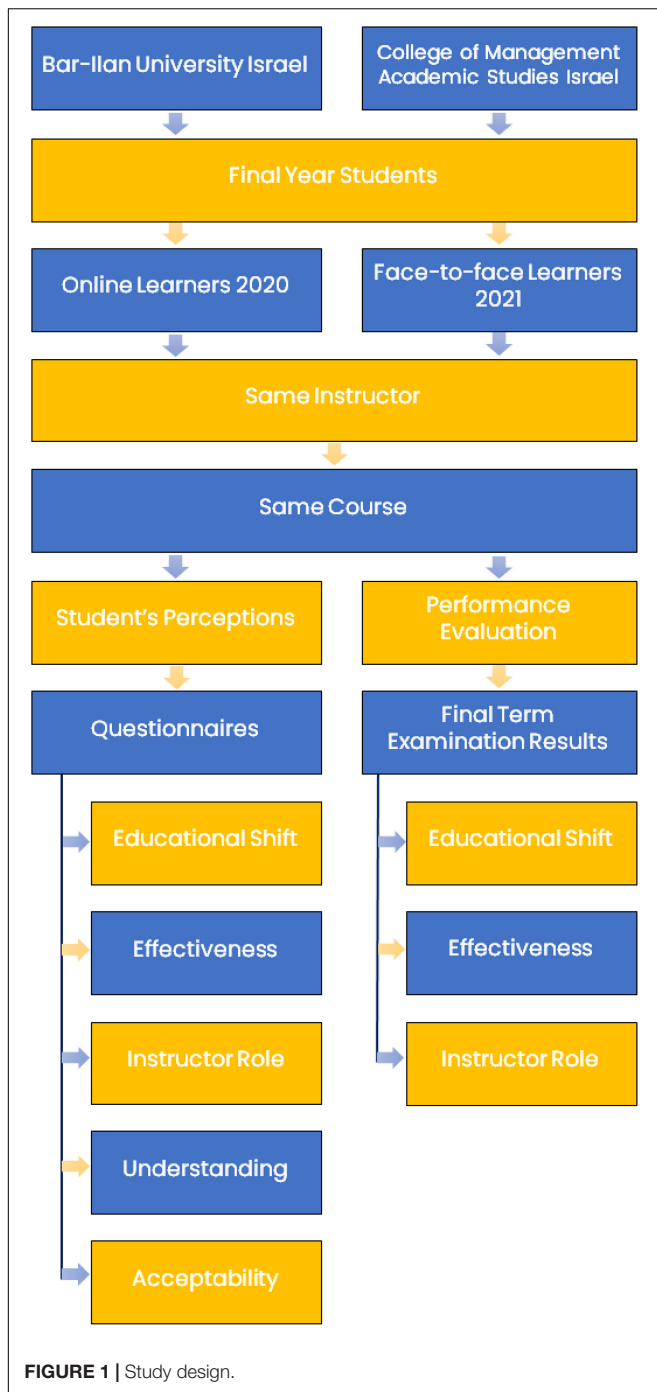
to face-to-face learners. The response rate of the participants was 100%. The final results were obtained from the examination office of both institutes with the subjects' permission.

Statistical Analysis

The data were arranged in an excel spreadsheet, and statistical analysis was performed in SPSS version 21. Descriptive and inferential statistics were applied to the data. The responses to the questionnaires were categorical variables, and the final

examination results were numerical variables. The chi-squared test compared the categorical variables. The Shapiro–Wilk test determined the normality of the numerical variables. Wilcoxon signed-rank test compared the paired non-parametric variables of final examination result scores. Further, an independent-sample t-test compared the parametric numerical variables of total marks of online learners with gender and age. In contrast, Mann–Whitney U-test compared the non-parametric numerical variables of final examination result scores (full marks of online learners) with gender and age. Where required, Pearson's test correlated parametric data, and Spearman's test correlated non-parametric data. All the statistical tests were performed considering the 95% significance level at $p \leq 0.05$.

RESULTS

This paper encompasses two groups, i.e., online learners and face-to-face learners of SQL learning. **Table 1** presents the demographic characteristics of both groups.

The survey includes 102 online learners (60, 58.8% males and 42, 41.2% females) with an average age of 24.47 ± 3.16 years and 95 face-to-face learners (54, 56.8% males and 41, 40.2% females) with an average age of 23.96 ± 3.15 years. **Figure 2** shows the percentages of previous online learning experiences of both groups. A comparative test was not conducted due to face-to-face learners' previous online learning experiences.

Table 2 shows the number of students who used online platforms, internet sources, and devices during online and face-to-face learning. Zoom was used to deliver the class in online learning. Therefore, all the students selected zoom. All the online and face-to-face learners used WhatsApp for updates related to the class activities in both ways of learning. Additionally, Gmail was used by all face-to-face learners to submit assignments and other class activities. Most students of both groups used mobile data as an internet source. Laptops and mobiles were the most frequently used online and face-to-face learning devices. The chi-square test of independence insignificantly compared the association between the online and face-to-face learners in the use of online platforms, internet sources, and devices.

The students were asked to rate the different factors relevant to online and face-to-face learning. **Figure 3** presents the rating percentages of students for different factors in online learning. **Figure 4** displays the rating percentages of students for different factors in face-to-face learning. The chi-square test of independence showed a substantial association of online learners with learning effectiveness [1.91 ± 1.12, χ^2 (4) = 70.84, $p \leq 0.001$], lesson clarity [2.71 ± 1.32, χ^2 (4) = 23.68, $p \leq 0.001$], clear understanding of the lesson [2.14 ± 1.02, χ^2 (4) = 70.84, $p \leq 0.001$], instructor availability [2.3 ± 1.05, χ^2 (4) = 109.07, $p \leq 0.001$], satisfactory response [2.47 ± 1.04, χ^2 (4) = 26.43, $p \leq 0.001$], independence [2 ± 1.04, χ^2 (4) = 67.6, $p \leq 0.001$], and spending extra time for learning lesson [2.55 ± 1.2, χ^2 (4) = 43.1, $p \leq 0.001$]. In contrast, a significant association in the face-to-face learners were found with the lesson clarity [2.4 ± 1.16, χ^2 (4) = 21.36, $p \leq 0.001$], instructor tools [2.08 ± 1.00, χ^2 (4) = 65.36, $p \leq 0.001$],

TABLE 1 | Demographic parameters.

Demographic parameters	Online learners N = 102, (% = 100)	Face-to-face learners N = 95, (% = 100)
Gender		
Male	60 (58.8)	54 (56.8)
Female	42 (41.2)	41 (40.2)
Age (y)		
Range	18–30	18–30
Mean ± SD	24.47 ± 3.16	23.96 ± 3.15
18–24	44 (43.1)	47 (49.5)
25–30	58 (56.9)	48 (50.5)
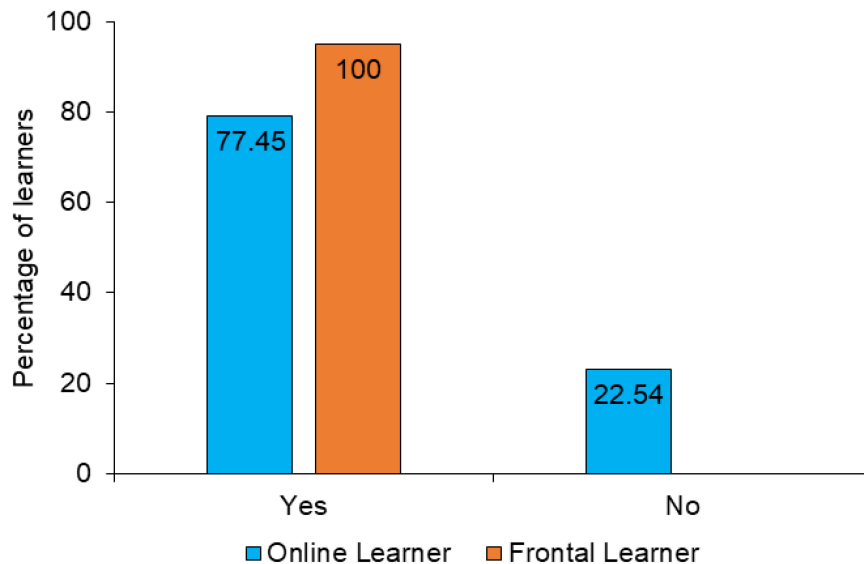
FIGURE 2 | Percentages of learners with previous experience of online learning.

TABLE 2 | Online platforms, internet sources, and devices used by online and face-to-face learners.

	Online learners		Face-to-face learners		Chi-squared	p-value
	N	**%**	**N**	**%**		
Online platforms						
Zoom	102	100	7	7.4	nc	nc
Google meet	13	12.7	11	11.6	0.347	0.556
WhatsApp	102	100	95	100	nc	nc
Gmail	24	23.5	95	100	nc	nc
YouTube	35	34.3	54	56.8	0.630	0.427
Internet sources						
Wi-Fi	67	65.7	39	41.1	0.039	0.843
Mobile Data	93	91.2	72	75.8	0.021	0.884
Landline	20	19.6	8	8.4	2.042	0.153
Devices						
Laptop	50	49	90	94.7	0.189	0.663
Computer	22	21.6	5	5.3	1.140	0.286
Mobile	95	93.1	48	50.5	0.132	0.716
Tablets	12	11.8	6	6.3	0.839	0.360

nc = not compared.
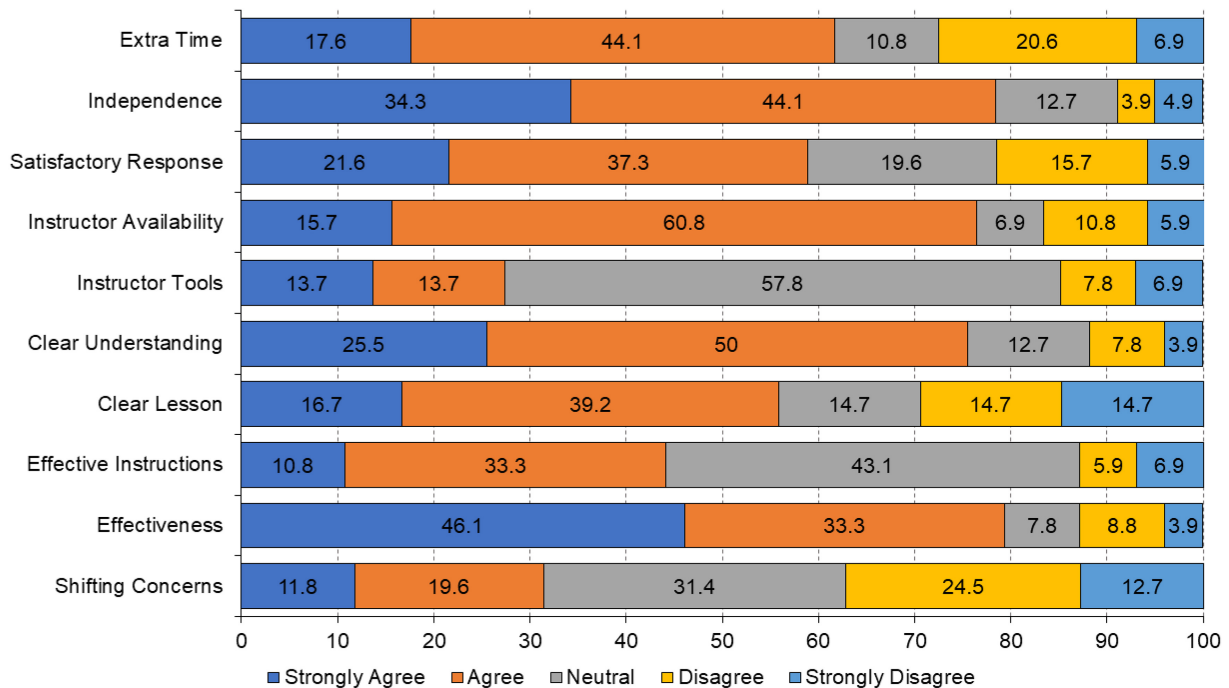
FIGURE 3 | Rating percentages of different parameters to online learning by Likert Scale.
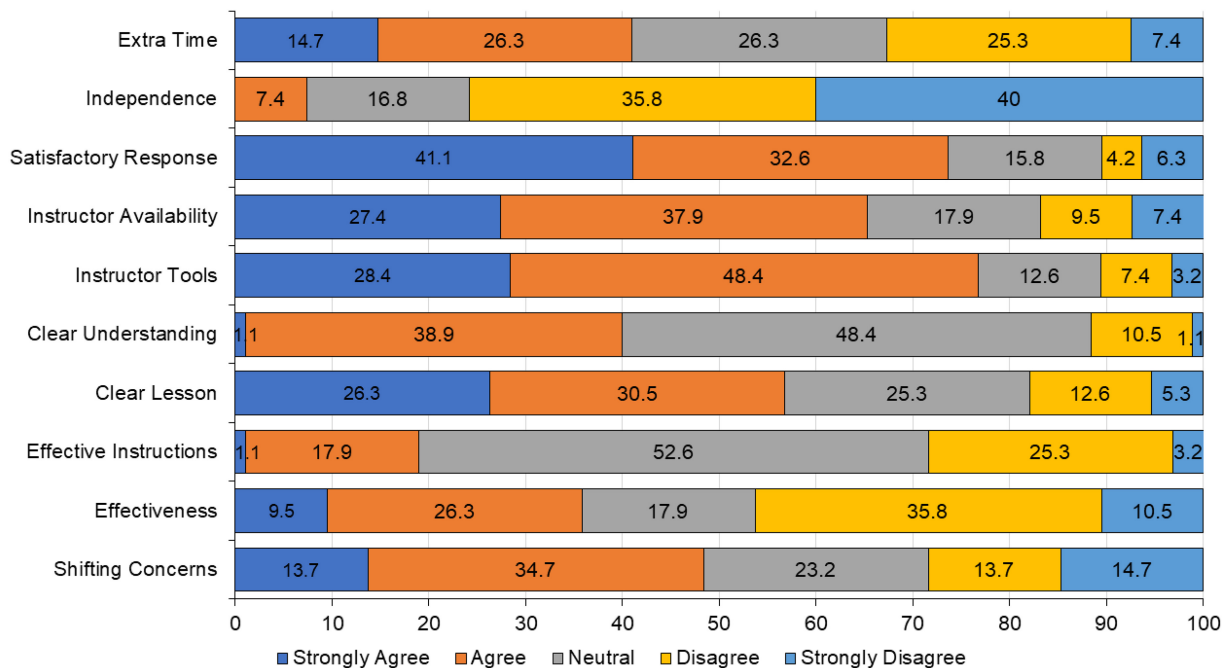
FIGURE 4 | Rating percentages of different face-to-face learning parameters by Likert Scale.

instructor availability [2.31 ± 1.2, χ^2 (4) = 30.84, $p \leq 0.001$], and the satisfactory response of the instructor [2.02 ± 1.15, χ^2 (4) = 50.2, $p \leq 0.001$] (**Table 3**). Interestingly, different online and face-to-face learning factors were found to be statistically

significant in the chi-square comparison test, as shown in **Table 3**.

Different important factors were compared with the demographic characteristics. **Table 4** compares the demographic

Parameters	Online learning		Face-to-face learning		Chi-square	*p*-value
	Mean ± SD	Median	Mean ± SD	Median		
Shifting concerns	3.06 ± 1.2	3	2.81 ± 1.27	3	35.372	≤0.01
Effectiveness	1.91 ± 1.12	2	3.11 ± 1.19	3	55.860	≤0.001
Effective instructions	2.64 ± 0.99	3	3.11 ± 0.77	3	51.297	≤0.001
Instructor clarity	2.71 ± 1.32	2	2.4 ± 1.16	2	51.297	≤0.001
Clear understanding of the lesson	2.14 ± 1.02	2	2.71 ± 0.71	3	55.730	≤0.001
Instructor tools	2.8 ± 1.01	3	2.08 ± 1.00	2	55.925	≤0.001
Instructor availability	2.3 ± 1.05	2	2.31 ± 1.19	2	66.158	≤0.001
Satisfactory response	2.47 ± 1.17	2	2.02 ± 1.15	2	68.370	≤0.001
Independence	2 ± 1.04	2	4.08 ± 0.93	4	39.169	≤0.001
Extra time	2.54 ± 1.2	2	2.84 ± 1.18	3	39.373	0.001

characteristics and different parameters for online learning. The chi-square test of independence showed a significant association between gender and online learning effectiveness χ^2 (4) = 11.04, $p \leq 0.05$, lesson clarity; χ^2 (4) = 9.64, $p \leq 0.05$, and understanding; χ^2 (4) = 9.62, $p \leq 0.05$. However, a significant association between age and online learning effectiveness; χ^2 (4) = 10.27, $p \leq 0.05$, clarity in lesson understanding; χ^2 (4) = 17.82, $p = 0.001$, instructor tools; χ^2 (4) = 30.8, $p \leq 0.001$, instructor availability; χ^2 (4) = 13.73, $p \leq 0.01$, instructor satisfactory response in the class; χ^2 (4) = 18.82, $p = 0.001$, learning independence; χ^2 (4) = 25.69, $p \leq 0.001$, and spending of extra time for learning; χ^2 (4) = 51.62, $p \leq 0.001$ were obtained by the chi-square test of independence. **Table 5** compares the demographic characteristics and important factors for face-to-face learning. A significant association was found only between age and student's concern of shifting the mode of learning; χ^2 (4) = 13.53, $p \leq 0.01$, and the satisfactory response of instructor; χ^2 (4) = 12.57, $p = 0.01$, during the face-to-face learning.

Pearson's correlation correlated different parameters for online and face-to-face learning. **Table 6** exhibits the significant correlation of various parameters between online and face-to-face learning. **Table 7** demonstrates the significant correlation of different parameters between online learning and face-to-face learning. The positive and negative correlations were calculated as $p \leq 0.05$ significant correlation, $p \leq 0.01$ very significant correlation, and $p \leq 0.001$ highly significant correlation.

The results were used to evaluate the online and face-to-face learners' performance. **Table 8** indicates the comparison between examination results of online and face-to-face learners by the Wilcoxon Signed Ranks Test. Total marks, objective, subjective, and viva of online learners and face-to-face learners were compared to test for significance. **Table 9** compares the demographic characteristics (gender and age) and the final examination results of the online and face-to-face learners. The total marks of online learners were compared with an independent-sample *t*-test. The *t*-test found a significant difference between the age categories and the total marks of the online learners; $t = -2.02$, $p = 0.05$. In contrast, both learners' objective, subjective, and viva marks and total marks of face-to-face learners were compared with the Mann–Whitney *U*-test.

Table 10 displays the correlation among the results marks of online and face-to-face learners. Parametric data were correlated with Pearson's test and non-parametric data with Spearman's test. The objective ($r_s = 0.521$, $p \leq 0.001$), subjective ($r_s = 0.53$, $p \leq 0.001$), and viva ($r_s = 0.708$, $p \leq 0.001$) of online learners significantly correlated with the full marks of online learners. Similarly, objective ($r_s = 0.774$, $p \leq 0.001$), subjective ($r_s = 0.862$, $p \leq 0.001$), and viva ($r_s = 0.505$, $p \leq 0.001$) of face-to-face learners significantly correlated with the full marks of the face-to-face learners. The subjective ($r_s = 0.559$, $p \leq 0.001$) and viva ($r_s = 0.213$, $p \leq 0.05$) results of the face-to-face learners showed a significant correlation with the objective and subjective of the face-to-face learners, respectively.

DISCUSSION

Online learning was a feasible and preferable solution to save the education sector during the lockdown period. However, shifting the education mode from face-to-face to online was challenging. Learners and instructors faced numerous difficulties during the shifting process, as mentioned in different studies (Chen et al., 2020; Dilmaç, 2020; Mailizar et al., 2020; Rapanta et al., 2020; Dolenc et al., 2021). Despite the challenges, instructors and learners have adopted online learning perfectly. Yet, students still have concerns about the improper infrastructures, inexperience, and disorganization. Therefore, this study evaluated the SQL learners' concerns regarding shifting the mode of education.

No doubt, online learning is entirely internet-based. In comparison, face-to-face learning combines online learning, where students get help from internet sources (Watson, 2008; Chisadza et al., 2021; Segbenya et al., 2022). Herein, face-to-face learners also use online platforms, internet sources, and devices for communication and a better understanding of the topics (**Table 2**). All online learners used Zoom to attend the class and WhatsApp for class updates during the lockdown. This finding correlates with studies that found that Zoom and WhatsApp were frequently used in online learning (Bahasoan et al., 2020; Singh et al., 2020; Bina et al., 2021; Pandey et al., 2021; Suadi, 2021). In contrast, all face-to-face learners used WhatsApp and

TABLE 4 | Comparison of demographic characteristics and different parameters for online learning.

Demographic characteristics	Strongly agree (N)	Agree (N)	Neutral (N)	Disagree (N)	Strongly disagree (N)	Chi-square tests	p-value
Shifting concerns							
Male	6	15	18	15	6	3.51	0.476
Female	6	5	14	10	7		
18–24	3	8	19	11	3	7.27	0.122
25–30	9	12	13	14	10		
Online learning experience	10	17	26	17	9	2.93	0.57
No online learning experience	2	3	6	8	4		
Effectiveness							
Male	35	18	3	3	1	11.04	≤ 0.05
Female	12	16	5	6	3		
18–24	22	9	5	7	1	10.27	≤ 0.05
25–30	25	25	3	2	3		
Online learning experience	36	28	4	7	4	5.1	0.277
No online learning experience	11	6	4	2	0		
Effective instructions							
Male	8	18	23	6	5	6.80	0.147
Female	3	16	21	0	2		
18–24	5	12	23	4	0	9.03	0.06
25–30	6	22	21	2	7		
Online learning experience	10	30	27	6	6	11.94	≤ 0.05
Noonline learning experience	1	4	17	0	1		
Lecturer clarity during instruction							
Male	14	26	8	5	7	9.64	≤ 0.05
Female	3	14	7	10	8		
18–24	3	21	8	7	5	7.23	0.124
25–30	14	19	7	8	10		
Online learning experience	15	29	11	12	12	1.95	0.745
No online learning experience	2	11	4	3	3		
Clear understanding of the lesson							
Male	21	29	5	4	1	9.62	≤ 0.05
Female	5	22	8	4	3		
18–24	4	31	6	3	0	17.82	0.001
25–30	22	20	7	5	4		
Online learning experience	22	34	11	8	4	8.03	≤ 0.05
No online learning experience	4	17	2	0	0		
Instructor tools							
Male	9	10	32	6	3	3.2	0.524
Female	5	4	27	2	4		
18–24	0	8	36	0	0	30.8	≤ 0.001
25–30	14	6	23	8	7		
Online learning experience	12	13	42	5	7	6.83	0.145
No online learning experience	2	1	17	3	0		
Instructor availability							
Male	12	37	3	5	3	3.48	0.48
Female	4	25	4	6	3		
18–24	6	34	0	4	0	13.73	≤ 0.01
25–30	10	28	7	7	6		
Online learning experience	9	48	7	10	5	7.41	0.115
No online learning experience	7	14	0	1	1		

(Continued)

TABLE 4 | (Continued)

Demographic characteristics	Strongly agree (N)	Agree (N)	Neutral (N)	Disagree (N)	Strongly disagree (N)	Chi-square tests	*p*-value
Satisfactory response							
Male	14	17	13	13	3	7.15	0.128
Female	12.9	22.4	11.8	9.4	3.5		
18–24	15	15	12	2	0	18.82	0.001
25–30	7	23	8	14	6		
Online learning experience	14	29	16	14	6	5.17	0.269
No online learning experience	8	9	4	2	0		
Independence							
Male	24	25	6	2	3	2.56	0.633
Female	11	20	7	2	2		
18–24	26	12	6	0	0	25.69	≤ 0.001
25–30	9	33	7	4	5		
Online learning experience	24	37	10	3	5	3.63	0.457
No online learning experience	11	8	3	1	0		
Extra Time							
Male	14	25	5	11	5	4.49	0.343
Female	4	20	6	10	2		
18–24	16	28	0	0	0	51.62	≤ 0.001
25–30	2	17	11	21	7		
Online learning experience	12	34	11	17	5	4.78	0.31
No online learning experience	6	11	0	4	2		

Gmail. WhatsApp was used for the class updates and Gmail for submitting assignments. As reported in a previous study (Selvaraj et al., 2021), all the online and face-to-face learners used WhatsApp because it is easy to use and a standard tool to communicate with the class and instructor. Most of the face-to-face learners (56.8%) watched additional YouTube tutorials to clarify the concepts compared to online learners (34.3%), as shown in **Table 2**. A study in Japan discovered that students who showed more interest in online learning used YouTube as a source of education (Winarni and Rasiban, 2021). Face-to-face learners used less internet compared to online learners. Further, most online learners used mobile (93.1%) for learning purposes. In comparison, 94.7% of face-to-face learners used laptops. Nevertheless, UNESCO reported that 706 million students did not have internet access, and about 826 million students did not have devices in their homes for online learning (UNECSO, 2020).

Previous studies reported improved skills, higher achievements, more success, self-confidence, satisfaction, and better performance among online learners (Zhang et al., 2006; Chen and Jones, 2007; Al-Qahtani and Higgins, 2013; Kay and McKlin, 2014; Wilkowski et al., 2014; Thai et al., 2017; Tratnik et al., 2019; Al-Balas et al., 2020; Shahzad et al., 2021). SQL is a learning technology declarative computer language course to perform and solve different problems by updating and retrieving the data (Halperin et al., 2013; Ahadi et al., 2015). Due to the computer-based learning of SQL courses, it is significant that online learners be more satisfied and independent. Herein, we found more satisfaction, comprehension, and independence in online learners. In contrast, face-to-face learners were pleased

with the instructor's tools, availability and response. Therefore, face-to-face learners were more concerned about the shift in the education model and most favored online learning (**Table 3**). However, studies that indicate students' preferences toward traditional education are also present (Hanafy et al., 2021; Selvaraj et al., 2021).

The study results showed that most males and females attending online learning remained neutral regarding the concerns of shifting the learning mode. In face-to-face learning, most males remained neutral, while females and students aged 18-24 showed concerns regarding shifting the mode of learning (**Tables 4**, **5**). In parallel, the chi-square test of independence confirmed a significant association between gender and age in the effectiveness of online learning (**Table 4**). Similar results have been reported in the literature (Afrouz and Crisp, 2020; Butnaru et al., 2021; Dahnial and Sagala, 2021). In our study, both genders and age groups agreed on the effectiveness of online learning. However, most males agreed, and females disagreed with the effectiveness of face-to-face learning. Online learners were more independent than face-to-face learners (**Table 3**). A significant association between online learners' independence and age groups has also been confirmed, as shown in **Table 4**. Further, both genders and age groups of online learners agreed, and face-to-face learners disagreed with the independence parameter. However, most of the online learners agreed, and face-to-face learners remained neutral regarding the clear understanding of the lesson (**Tables 4**, **5**). A previous study stated similar results related to the online learners' independence due to access to unlimited online data and flexibility in learning (Zabaniotou, 2021).

TABLE 5 | Comparison of demographic characteristics and different parameters for face-to-face learning.

Demographic characteristics	Strongly agree (N)	Agree (N)	Neutral (N)	Disagree (N)	Strongly disagree (N)	Chi-square tests	p-value
Shifting concerns							
Male	9	15	17	6	7	7.17	0.127
Female	4	18	5	7	7		
18–24	7	23	11	3	3	13.53	≤0.01
25–30	6	10	11	10	11		
Effectiveness							
Male	4	16	11	15	8	5.94	0.203
Female	5	9	6	19	2		
18–24	1	15	10	19	2	11.03	0.026
25–30	8	10	7	15	8		
Effective instructions							
Male	1	10	27	15	1	1.94	0.747
Female	0	7	23	9	2		
18–24	1	11	21	14	0	7.4	0.116
25–30	0	6	29	10	3		
Lecturer clarity during instruction							
Male	12	19	12	8	3	2.63	0.62
Female	13	10	12	4	2		
18–24	15	14	12	5	1	3.15	0.532
25–30	10	15	12	7	4		
Clear understanding of the lesson							
Male	0	24	26	4	0	4.76	0.312
Female	1	13	20	6	1		
18–24	1	14	26	5	1	4.96	0.291
25–30	0	23	20	5	0		
Instructor tools							
Male	20	25	4	4	1	6.76	0.149
Female	7	21	8	3	2		
18–24	14	22	7	4	0	3.59	0.464
25–30	13	24	5	3	3		
Instructor availability							
Male	14	20	12	5	3	1.993	0.737
Female	12	16	5	4	4		
18–24	15	17	11	3	1	6.75	0.149
25–30	11	19	6	6	6		
Satisfactory response							
Male	26	15	8	3	2	4.4	0.354
Female	13	16	7	1	4		
18–24	15	21	9	2	0	12.57	0.01
25–30	24	10	6	2	6		
Independence							
Male	0	5	7	18	24	2.55	0.466
Female	0	2	9	16	14		
18–24	0	3	7	15	22	1.8	0.615
25–30	0	4	9	19	16		
Extra time							
Male	10	12	13	14	5	2.87	0.578
Female	4	13	12	10	2		
18–24	5	9	13	17	3	7.44	0.114
25–30	9	16	12	7	4		

In online and face-to-face learning, different factors correlated positively and negatively (**Table 6**). For instance, concerns about the educational shift among online learners positively correlated with effective instructions, lecturer clarity during the instruction, and instructor tools. The effectiveness of online learning depends upon the well-preparedness of the

TABLE 6 | Significant correlation of different parameters regarding online learning and face-to-face learning.

Parameters	Online learning				Face-to-face learning			
	Correlation	Parameters	Pearson's coefficient	*p*-value	Correlation	Parameters	Pearson's coefficient	*p*-value
Shifting concerns	Positive	Effective instructions	0.313	0.001	Positive	Clear lesson from the instructor	0.222	≤0.05
	Positive	Lecturer clarity during instruction	0.308	≤0.01	Positive	Satisfactory response	0.242	≤0.05
	Positive	Instructor tools	0.271	≤0.01	Negative	Extra time	−0.383	≤0.001
	Negative	Instructor availability	−0.254	0.01				
	Negative	Satisfactory response	−0.280	≤0.01				
Effectiveness	Positive	Lecturer clarity during instruction	0.610	≤0.001	Positive	Clear understanding of the lesson	0.246	≤0.05
	Positive	Clear understanding of the lesson	0.571	≤0.001	Positive	Instructor tools	0.288	≤0.01
	Positive	Instructor availability	0.400	≤0.001	Negative	Instructor availability	−0.466	≤0.001
	Negative	Satisfactory response	−0.237	≤0.05	Positive	Independence	0.475	≤0.001
	Positive	Independence	0.237	≤0.05	Positive	Extra time	0.334	0.001
Effective instructions	Negative	Clear understanding of the lesson	−0.392	≤0.001	Negative	Instructor availability	−0.224	≤0.05
	Negative	Instructor availability	−0.282	≤0.01	Negative	Independence	−0.3	≤0.05
	Negative	Satisfactory response	−0.212	≤0.05	Negative	Extra time	−0.485	≤0.001
Lecturer clarity during instruction	Positive	Clear understanding of the lesson	0.593	≤0.001	Negative	Instructor availability	−0.387	≤0.001
	Positive	Instructor tools	0.316	0.001	Positive	Satisfactory Response	0.514	≤0.001
	Negative	Satisfactory response	−0.443	≤0.001	Negative	Independence	−0.535	≤0.001
Clear understanding of the lesson	Positive	Instructor tools	0.227	≤0.05	Negative	Instructor availability	−0.329	0.001
	Positive	Instructor availability	0.211	≤0.05				
Instructor tools	Negative	Satisfactory response	−0.328	0.001	Negative	Instructor availability	−0.381	≤0.001
					Positive	Satisfactory response	0.548	≤0.001
Instructor availability	Positive	Extra time	0.288	≤0.01	Negative	Satisfactory response	−0.611	≤0.001
Satisfactory response	Positive	Independence	0.376	≤0.001	Negative	Independence	−0.264	0.01
	Positive	Extra time	0.203	≤0.05	Negative	Extra time	−0.250	≤0.05
Independence	Positive	Extra time	0.575	≤0.001	Positive	Extra time	0.648	≤0.001
Extra time	Negative	Clear understanding of the lesson	−0.297	≤0.01	Negative	Clear lesson from the instructor	−0.207	≤0.05

130

TABLE 7 | Significant correlation between online and face-to-face learning according to different parameters.

Online learning	Correlation	Face-to-face learning	Pearson's coefficient	p-value
Shifting concerns	Negative	Shifting concerns	−0.344	0.001
	Negative	Instructor tools	−0.309	≤0.01
	Negative	Satisfactory response	−0.320	≤0.01
	Positive	Extra time	0.437	≤0.001
Effectiveness	Positive	Effectiveness	0.312	≤0.01
	Negative	Effective instructions	−0.212	≤0.05
Effective Instructions	Negative	Effective instructions	−0.228	≤0.05
	Positive	Clear lesson from the instructor	0.349	0.001
	Positive	Satisfactory response	0.295	≤0.05
	Positive	Extra time	0.260	≤0.05
Lecturer clarity during instruction	Negative	Shifting concerns	−0.451	≤0.001
	Negative	Satisfactory response	−0.357	≤0.001
	Positive	Extra time	0.262	0.01
Clear understanding of the lesson	Negative	Satisfactory response	−0.398	≤0.001
Instructor tools	Negative	Shifting concerns	−0.397	≤0.001
	Negative	Effective instructions	−0.281	≤0.01
	Negative	Lecturer clarity during instruction	−0.447	≤0.001
	Positive	Instructor availability	0.244	≤0.05
	Negative	Satisfactory response	−0.504	≤0.001
	Positive	Independence	0.424	≤0.001
	Positive	Extra time	0.548	≤0.001
Instructor availability	Negative	Lecturer clarity during instruction	−0.409	≤0.001
	Negative	Satisfactory response	−0.304	≤0.01
Satisfactory response	Positive	Shifting concerns	0.438	≤0.001
	Negative	Effectiveness	−0.212	≤0.05
	Positive	Effective instructions	0.523	≤0.001
	Positive	Satisfactory response	0.267	≤0.01
	Negative	Independence	−0.415	≤0.001
	Negative	Extra time	−0.732	≤0.001
Independence	Positive	Lecturer clarity during instruction	0.504	≤0.001
	Negative	Independence	−0.459	≤0.001
	Negative	Extra time	−0.407	≤0.001
Extra time	Positive	Effectiveness	0.381	≤0.001
	Negative	Extra time	−0.203	≤0.05

TABLE 8 | Paired-wise comparison between examination results of online and face-to-face learners.

	Online learners (n = 102)		Face-to-face learners (n = 95)		Mean difference (Wilcoxon signed ranks test)	
	Mean	SD	Mean	SD	Z	p-value
Total marks	85.79	2.81	75.31	5.99	−8.27	≤0.001
Objective	17.45	1.19	15.13	2.49	−6.37	≤0.001
Subjective	46.47	1.53	37.42	3.50	−8.42	≤0.001
Viva	21.87	1.91	22.69	1.74	−3.21	0.001

instructors, clear instructions, and advanced technologies. Previous studies supported the findings of this study (Gilbert, 2015; Sun and Chen, 2016; Muthuprasad et al., 2021). In contrast, it negatively correlated with instructor availability and satisfactory responses. Online learners seem to encounter more difficulty facilitating effective learning situations where they are dissatisfied with the instructor's availability and responses. As a result, faculty in these situations have difficulty engaging their students and may assume that these difficulties are related primarily to insatiable students (Dziuban et al., 2015). Concerns about the educational shift among face-to-face learners positively correlated with the following parameters: lecturer clarity during the instruction and the instructor's satisfactory response. On the other hand, it negatively correlated

with spending extra time. Different factors also correlated with online and face-to-face learning (**Table 7**). Online learners negatively correlated with face-to-face learners regarding concerns about the shift in the mode of education, effective instructions, independence, and spending extra time. However, a positive correlation was found between the effectiveness and satisfactory response of the instructor in online and face-to-face learnings.

The final examination results helped evaluate the performance of online and face-to-face learners (**Table 8**). The performance of online learners was significantly higher in total marks, objective and subjective, compared to face-to-face learners. Similarly, studies have confirmed higher achievements, academic success, and better performance in online learners (Zhang et al., 2006; Al-Qahtani and Higgins, 2013; Thai et al., 2017). In contrast, face-to-face learners' viva results were significantly higher than online learners. The total marks for male and female online learners were almost similar; however, female face-to-face learners had slightly higher marks than males. Meanwhile, no significant differences were observed between the total marks, objectiev, subjective, and viva of males and females and age groups of both online and face-to-face learners (**Table 9**). Likewise, total marks of online and face-to-face learners were negatively correlated ($r_s = -0.021$; **Table 10**). The mean difference ($Z = 8.27$, $p = \leq 0.001$) of the total marks of the online learners was higher than the face-to-face learners (**Table 8**). One of the problems in online learning is cheating in examinations. This study's results indicate that online learners might have cheated in the objective and subjective portion of the exam due to their extraordinary marks. Meanwhile, face-to-face learners had higher grades in viva than online learners. The viva results confirmed a clearer understanding of the subject in face-to-face learners than in online learners. Such type of results denotes a chance of cheating amongst online learners. Hence, cheating reduces the significance of the evaluation system in online learning. Different studies have already reported the problem of cheating in online learning (Bilen and Matros, 2021; Rodriguez et al., 2021; Tarigan et al., 2021; Tiong and Lee, 2021). Different solutions have been proposed to detect and overcome this e-cheating, such as using a deep learning approach to monitoring the internet protocol and student behavior (Tiong and Lee, 2021). Further options are also considered, such as using a camera, lesser time, outlier detector, abnormal grades, and others (Bilen and Matros, 2021; Kamalov et al., 2021).

The rapid implementation of online learning has faced administration, technology, course activities' access, materials, and instructors' and students' communication problems. Despite extensive resource allocation and rigorous processes, it still constitutes a significant concern for many. However, all educational stakeholders have adapted to online learning instantaneously (Lockee, 2021). This study confirmed the system's rapid adaption, confidence, and approval. Online learning is now more accessible and widely available to the next generation. Thus, there is a clear path to implementation since students' performance can be enhanced by online learning.

TABLE 9 | Descriptive statistics with independent sample *t*-test/Mann–Whitney *U*-test compares the gender and age categories with examination results of online and face-to-face learners.

Online learners

	Gender						Age					
	Male (*n* = 60)		Female (*n* = 42)		Mean difference (*t*-test/Mann–Whitney *U*-test)		18–24 (*n* = 44)		25–30 (*n* = 58)		Mean difference (*t*-test/Mann–Whitney *U*-test)	
	Mean	SD	Mean	SD	t/Z[a]	*p*-value	Mean	SD	Mean	SD	t/Z[a]	*p*-value
Total marks	85.65	2.92	86.00	2.66	−0.62	0.54	85.16	2.85	86.28	2.70	−2.02	0.05
Objective	17.42	1.31	17.50	1.02	−0.18[a]	0.86	17.34	1.22	17.53	1.17	−0.68[a]	0.50
Subjective	46.55	1.55	46.36	1.53	−0.82[a]	0.42	46.16	1.80	46.71	1.26	−1.56[a]	0.12
Viva	21.68	1.95	22.14	1.84	−1.15[a]	0.25	21.66	2.13	22.03	1.73	−0.89[a]	0.38

Face-to-face learners

	Gender						Age					
	Male (*n* = 54)		Female (*n* = 41)		Mean difference (Mann–Whitney *U*-test)		18–24 (*n* = 47)		25–30 (*n* = 48)		Mean difference (Mann–Whitney *U*-test)	
	Mean	SD	Mean	SD	Z	*p*-value	Mean	SD	Mean	SD	Z	*p*-value
Total marks	74.65	6.22	76.17	5.63	−1.02	0.31	74.87	7.23	75.73	4.51	−0.11	0.91
Objective	14.93	2.54	15.39	2.42	−1.01	0.31	14.70	2.77	15.54	2.12	−1.23	0.22
Subjective	37.02	3.51	37.95	3.46	−1.34	0.18	37.15	4.04	37.69	2.90	−0.20	0.85
Viva	22.63	1.75	22.78	1.74	−0.54	0.59	23.00	1.96	22.40	1.45	−1.61	0.11

[a]*Mean difference was calculated by Mann–Whitney U-test.*

TABLE 10 | Correlation of examination results of online and face-to-face learners.

Online learners		1	2	3	4	5	6	7	8
1. Total marks	Pearson's coefficient	1							
	p-value								
2. Objective	Spearman's coefficient	0.521	1						
	p-value	$\leq$0.001							
3. Subjective	Spearman's coefficient	0.530	0.14	1					
	p-value	$\leq$0.001	0.161						
4. Viva	Spearman's coefficient	0.708	0.127	−0.036	1				
	p-value	$\leq$0.001	0.203	0.716					
Face-to-face learners									
5. Total Marks	Spearman's coefficient	−0.021	0.024	−0.076	0.049	1			
	p-value	0.84	0.814	0.466	0.64				
6. Objective	Spearman's coefficient	−0.018	−0.089	0.035	0.018	0.774	1		
	p-value	0.864	0.392	0.734	0.859	$\leq$0.001			
7. Subjective	Spearman's coefficient	−0.09	0.061	−0.133	−0.006	0.862	0.559	1	
	p-value	0.385	0.557	0.198	0.952	$\leq$0.001	$\leq$0.001		
8. Viva	Spearman's coefficient	0.065	0.113	−0.105	0.109	0.505	0.146	0.213	1
	p-value	0.534	0.276	0.311	0.293	$\leq$0.001	0.159	$\leq$0.05	

Nevertheless, improvement in the evaluation process is a substantial requisite in online learning.

LIMITATIONS

This study evaluated online and face-to-face SQL learners' perceptions regarding a few variables. The sample size was relatively small, and all the participants were medium-level SQL course learners at Bar-Ilan University Israel and the College of Management Academic Studies Israel. Hence, future studies should evaluate perceptions of other variables with a larger sample. Further, opinions of other education system stakeholders such as teachers and parents are required. To better understand this phenomenon and expand the database and quantitative research, the researchers intend to perform qualitative analyses and distribute a questionnaire to students nationwide. Apart from this, there are chances of e-chatting and barriers to learning practical courses in online learning. Therefore, further studies are required to find the solutions to the e-chatting and online practical courses.

CONCLUSION

Online learning is preferable to save the education sector and continue learning during a health crisis. Rapid adaptation and acceptance of online learning have been scrutinized by investigating the students' success in the course. Nonetheless, the significance of face-to-face learning cannot be denied. This study discovered that online learners were more satisfied, comfortable, independent, accessible, and performed remarkably in the e-examinations. However, face-to-face learners were more satisfied with the instructor's tools and dissatisfied with the dependence on the instructor. Online learners performed excellently in written examinations, while face-to-face learners performed excellently in oral tests. Hence, online learning is substantial for future education but needs advancements for redesigning and reimagining to develop an online learning environment for critical thinking in higher education.

DATA AVAILABILITY STATEMENT

The original contributions presented in this study are included in the article/**Supplementary Material**, further inquiries can be directed to the corresponding author.

ETHICS STATEMENT

The study involving human participants was reviewed and approved by the Ethics Committee of Bar-Ilan University, Israel. Written informed consent to participate in this study was not required from the participants in accordance with the national legislation and the institutional requirements.

SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/feduc.2022.935997/full#supplementary-material

REFERENCES

Adedoyin, O. B., and Soykan, E. (2020). Covid-19 pandemic and online learning: the challenges and opportunities. *Interact. Learn. Environ.* 1–13. doi: 10.1080/10494820.2020.1813180

Adeyeye, B., Ojih, S. E., Bello, D., Adesina, E., Yartey, D., Ben-Enukora, C., et al. (2022). Online learning platforms and covenant university students' academic performance in practical related courses during Covid-19 pandemic. *Sustainability* 14:878. doi: 10.3390/su14020878

Afrouz, R., and Crisp, B. R. (2020). Online education in social work, effectiveness, benefits, and challenges: a scoping review. *Aust. Soc. Work* 74, 55–67. doi: 10.1080/0312407X.2020.1808030

Ahadi, A., Prior, J., Behbood, V., and Lister, R. (2015). "A quantitative study of the relative difficulty for novices of writing seven different types of SQL queries," in *Proceedings of the Annual Conference on Innovation and Technology in Computer Science Education*, (New York, NY: Association for Computing Machinery), 201–206. doi: 10.1145/2729094.2742620

Al-Balas, M., Al-Balas, H. I., Jaber, H. M., Obeidat, K., Al-Balas, H., Aborajooh, E. A., et al. (2020). Distance learning in clinical medical education amid COVID-19 pandemic in Jordan: current situation, challenges, and perspectives. *BMC Med. Educ.* 20:341. doi: 10.1186/s12909-020-02257-4

Ali, A., and Ahmad, I. (2020). Key factors for determining student satisfaction in distance learning courses: a study of Allama Iqbal Open University. *Contemp. Educ. Technol.* 2, 114–127. doi: 10.30935/cedtech/6047

Almahasees, Z., and Jaccomard, H. (2020). Facebook translation service (FTS) usage among jordanians during COVID-19 lockdown. *Adv. Sci. Technol. Eng. Syst.* 5, 514–519. doi: 10.25046/aj050661

Almahasees, Z., Mohsen, K., and Amin, M. O. (2021). Faculty's and students' perceptions of online learning during COVID-19. *Front. Educ.* 6:119. doi: 10.3389/feduc.2021.638470

Al-Qahtani, A. A. Y., and Higgins, S. E. (2013). Effects of traditional, blended and e-learning on students' achievement in higher education. *J. Comput. Assist. Learn.* 29, 220–234. doi: 10.1111/j.1365-2729.2012.00490.x

Arora, S., Chaudhary, P., and Singh, R. K. (2021). Impact of coronavirus and online exam anxiety on self-efficacy: the moderating role of coping strategy. *Interact. Technol. Smart Educ.* 18, 475–492. doi: 10.1108/ITSE-08-2020-0158

Baanqud, N. S., Al-Samarraie, H., Alzahrani, A. I., and Alfarraj, O. (2020). Engagement in cloud-supported collaborative learning and student knowledge construction: a modeling study. *Int. J. Educ. Technol. High. Educ.* 17, 1–23. doi: 10.1186/s41239-020-00232-z

Bahasoan, A. N., Wulan, A., Muhammad, M., and Aswar, R. (2020). Effectiveness of online learning in pandemic Covid-19. *Int. J. Sci. Technol. Manag.* 1, 100–106. doi: 10.46729/ijstm.v1i2.30

Bakker, A., and Wagner, D. (2020). Pandemic: lessons for today and tomorrow? *Educ. Stud. Math.* 104, 1–4. doi: 10.1007/s10649-020-09946-3

Bartley, S. J., and Golek, J. H. (2004). Evaluating the cost effectiveness of online and face-to-face instruction. *Educ. Technol. Soc.* 7, 167–175. doi: 10.2307/jeductechsoci.7.4.167

Beck, C. W., and Blumer, L. S. (2016). Alternative realities: faculty and student perceptions of instructional practices in laboratory courses. *CBE Life Sci. Educ.* 15:ar52. doi: 10.1187/cbe.16-03-0139

Bilen, E., and Matros, A. (2021). Online cheating amid COVID-19. *J. Econ. Behav. Organ.* 182, 196–211. doi: 10.1016/j.jebo.2020.12.004

Bina, N. S., Ramadhani, R., Andhany, E., and Wardani, H. (2021). Statistical skills analysis of students using online-learning platforms such as whatsapp, youtube, and zoom meetings during Covid-19 pandemic. *JTAM* 5, 405–417. doi: 10.31764/jtam.v5i2.5166

Bujar, M., McAuslane, N., Walker, S., and Salek, S. (2019). The reliability and relevance of a quality of decision making instrument, quality of decision-making orientation scheme (QoDoS), for use during the lifecycle of medicines. *Front. Pharmacol.* 9:17. doi: 10.3389/fphar.2019.00017

Butnaru, G. I, Niță, V., Anichiti, A., and Brînză, G. (2021). The effectiveness of online education during covid 19 pandemic—a comparative analysis between the perceptions of academic students and high school students from romania. *Sustainability* 13:5311. doi: 10.3390/su13095311

Butz, N. T., Stupnisky, R. H., and Pekrun, R. (2015). Students' emotions for achievement and technology use in synchronous hybrid graduate programmes:

a control-value approach. *Res. Learn. Technol.* 23:26097. doi: 10.3402/rlt.v23.26097

Calhoun, K. E., Yale, L. A., Whipple, M. E., Allen, S. M., Wood, D. E., and Tatum, R. P. (2020). The impact of COVID-19 on medical student surgical education: implementing extreme pandemic response measures in a widely distributed surgical clerkship experience. *Am. J. Surg.* 220, 44–47. doi: 10.1016/j.amjsurg.2020.04.024

Chen, C. C., and Jones, K. T. (2007). Blended-learning vs. Traditional classroom settings: analyzing students' satisfaction with inputs and learning processes in an MBA accounting course. *Adv. Account. Educ. Teach. Curric. Innov.* 8, 25–37. doi: 10.1016/S1085-4622(07)08002-9

Chen, T., Cong, G., Peng, L., Yin, X., Rong, J., and Yang, J. (2020). Analysis of user satisfaction with online education platforms in china during the covid-19 pandemic. *Healthcare* 8:200. doi: 10.3390/healthcare8030200

Chisadza, C., Clance, M., Mthembu, T., Nicholls, N., and Yitbarek, E. (2021). Online and face-to-face learning: evidence from students' performance during the Covid-19 pandemic. *African Dev. Rev.* 33, S114–S125. doi: 10.1111/1467-8268.12520

Crossley, S. A., and McNamara, D. S. (2016). *Adaptive Educational Technologies for Literacy Instruction*. Milton Park: Taylor and Francis. doi: 10.4324/9781315647500

Dahnial, I., and Sagala, R. W. (2021). The effect of online learning based on socio scientific issues (SSI) on improving learning independent and critical thinking student faculty of education and education science universitas muhammadiyah sumatera utara in the pandemic COVID-19. *J. Educ. Technol.* 7, 145–152. doi: 10.30596/EDUTECH.V7I1.6517

D'Auria Stanton, A. (2006). Bridging the academic/practitioner divide in marketing: an undergraduate course in data mining. *Mark. Intell. Plan.* 24, 233–244. doi: 10.1108/02634500610665709

Dhawan, S. (2020). Online learning: a panacea in the time of COVID-19 Crisis. *J. Educ. Technol. Syst.* 49, 5–22. doi: 10.1177/0047239520934018

Dilmaç, S. (2020). Students' opinions about the distance education to art and design courses in the pandemic process. *World J. Educ.* 10:113. doi: 10.5430/wje.v10n3p113

Dolenc, K., Šorgo, A., and Ploj Virtič, M. (2021). The difference in views of educators and students on Forced Online Distance Education can lead to unintentional side effects. *Educ. Inf. Technol.* 26, 7079–7105. doi: 10.1007/s10639-021-10558-4

Dziuban, C., Moskal, P., Thompson, J., Kramer, L., DeCantis, G., and Hermsdorfer, A. (2015). Student satisfaction with online learning: is it a psychological contract? *J. Asynchronous Learn. Netw.* 19:n2. doi: 10.24059/olj.v19i2.496

Englund, C., Olofsson, A. D., and Price, L. (2017). Teaching with technology in higher education: understanding conceptual change and development in practice. *High. Educ. Res. Dev.* 36, 73–87. doi: 10.1080/07294360.2016.1171300

Gherheş, V., Stoian, C. E., Fărcaşiu, M. A., and Stanici, M. (2021). E-learning vs. Face-to-face learning: analyzing students' preferences and behaviors. *Sustainability* 13:4381. doi: 10.3390/su13084381

Gilbert, B. (2015). Online learning revealing the benefits and challenges. *Fish. Digit. Publ. Educ.* 1–32.

Gratton-Lavoie, C., and Stanley, D. (2009). Teaching and learning principles of microeconomics online: an empirical assessment. *J. Econ. Educ.* 40, 3–25. doi: 10.3200/JECE.40.1.003-025

Gurukkal, R. (2020). Will COVID 19 turn higher education into another mode? *High. Educ. Future* 7, 89–96. doi: 10.1177/2347631120931606

Halperin, D., Weitz, K., Howe, B., Ribalet, F., Saito, M. A., and Virginia Armbrust, E. (2013). "Real-time collaborative analysis with (almost) pure SQL: a case study in biogeochemical oceanography," in *Proceeding of the ACM International Conference Series*, (New York, NY: ACM Press), 1–12. doi: 10.1145/2484838.2484880

Hanafy, S. M., Jumaa, M. I., and Arafa, M. A. (2021). A comparative study of online learning in response to the coronavirus disease 2019 pandemic versus conventional learning. *Saudi Med. J.* 42, 324–331. doi: 10.15537/SMJ.2021.42.3.20200741

Heyd-Metzuyanim, E., Sharon, A. J., and Baram-Tsabari, A. (2021). Mathematical media literacy in the COVID-19 pandemic and its relation to school mathematics education. *Educ. Stud. Math.* 108, 201–225. doi: 10.1007/s10649-021-10075-8

Isaeva, R., Eisenschmidt, E., Vanari, K., and Kumpas-Lenk, K. (2020). Students' views on dialogue: improving student engagement in the quality assurance process. *Qual. High. Educ.* 26, 80–97. doi: 10.1080/13538322.2020.1729307

Jehad, A., Raja, M., Elham, H., Haifa, B. I., and Hussam, N. F. (2020). Students' perceptions of E-learning platforms (moodle, microsoft teams and zoom platfomrs) in the university of Jordan Education and its relation to self-study and academic achievement during COVID-19 pandemic. *Adv. Res. Stud. J.* 11, 21–33.

Kamalov, F., Sulieman, H., and Calonge, D. S. (2021). Machine learning based approach to exam cheating detection. *PLoS One* 16:e0254340. doi: 10.1371/journal.pone.0254340

Kay, J. S., and McKlin, T. (2014). "The challenges of using a MOOC to introduce "Absolute beginners" to programming on specialized hardware," in *Proceedings of the in L@S 2014 – 1st ACM Conference on Learning at Scale*, (New York, NY: Association for Computing Machinery), 211–212. doi: 10.1145/2556325.2567886

Kentnor, H. E. (2015). Distance education and the evolution of online learning in the United States. *Curric. Teach. Dialogue* 17, 21.

Khalil, R., Mansour, A. E., Fadda, W. A., Almisnid, K., Aldamegh, M., Al-Nafeesah, A., et al. (2020). The sudden transition to synchronized online learning during the COVID-19 pandemic in Saudi Arabia: a qualitative study exploring medical students' perspectives. *BMC Med. Educ.* 20:285. doi: 10.1186/s12909-020-02208-z

Khan, M. A., Vivek, V., Nabi, M. K., Khojah, M., and Tahir, M. (2021). Students' perception towards e-learning during covid-19 pandemic in India: an empirical study. *Sustainability* 13, 1–14. doi: 10.3390/su13010057

Kinney, L., Liu, M., and Thornton, M. A. (2012). "Faculty and student perceptions of online learning in engineering education," in *Proceedings of the 2012 ASEE Annual Conference & Exposition*, San Antonio, TX, 25.630.1–25.630.20. doi: 10.18260/1-2-21387

Kulal, A., and Nayak, A. (2020). A study on perception of teachers and students toward online classes in Dakshina Kannada and Udupi District. *Asian Assoc. Open Univ. J.* 15, 285–296. doi: 10.1108/aaouj-07-2020-0047

Lai, P. P. Y. (2020). "Engaging students in SQL learning by challenging peer during the pandemic," in *Proceedings of 2020 IEEE International Conference on Teaching, Assessment, and Learning for Engineering, TALE 2020*, (Piscataway, NY: Institute of Electrical and Electronics Engineers Inc), 205–212. doi: 10.1109/TALE48869.2020.9368433

Lee, Y. J. (2011). A study on the effect of teaching innovation on learning effectiveness with learning satisfaction as a mediator. *World Trans. Eng. Technol. Educ.* 9, 92–101.

Lockee, B. B. (2021). Online education in the post-COVID era. *Nat. Electron.* 4, 5–6. doi: 10.1038/s41928-020-00534-0

Luxatia (2020). *The Importance of Digital Learning Spaces During COVID-19 and Beyond.* Berlin: Luxatia International.

Mailizar, M., Almanthari, A., Maulina, S., and Bruce, S. (2020). Secondary school mathematics teachers' views on e-learning implementation barriers during the COVID-19 pandemic: the case of Indonesia. *Eurasia J. Math. Sci. Technol. Educ.* 16:em1860. doi: 10.29333/EJMSTE/8240

Majeed, M. M., Durrani, M. S., Bashir, M. B., and Ahmed, M. (2020). COVID-19 and dental education in Pakistan. *J. Coll. Physicians Surg. Pak.* 30, 115–117. doi: 10.29271/jcpsp.2020.10.115

Mamun, M. A., Al, Lawrie, G., and Wright, T. (2020). Instructional design of scaffolded online learning modules for self-directed and inquiry-based learning environments. *Comput. Educ.* 144:103695. doi: 10.1016/j.compedu.2019.103695

Martin, F., Ritzhaupt, A., Kumar, S., and Budhrani, K. (2019). Award-winning faculty online teaching practices: course design, assessment and evaluation, and facilitation. *Internet High. Educ.* 42, 34–43. doi: 10.1016/j.iheduc.2019.04.001

Martin, F., Wang, C., and Sadaf, A. (2018). Student perception of helpfulness of facilitation strategies that enhance instructor presence, connectedness, engagement and learning in online courses. *Internet High. Educ.* 37, 52–65. doi: 10.1016/j.iheduc.2018.01.003

McLoughlin, C., and Lee, M. J. W. (2010). Personalised and self regulated learning in the Web 2.0 era: international exemplars of innovative pedagogy using social software. *Australas. J. Educ. Technol.* 26, 28–43. doi: 10.14742/ajet.1100

Methkal, Y., Algani, A., Eshan, J., Education, F., and College, S. (2021). Online learning/teaching in the time of coronavirus pandemic in Israel : highlight a hard situation. *Psychol. Educ. J.* 58, 6618–6627. doi: 10.17762/PAE.V58I1.4152

Muthuprasad, T., Aiswarya, S., Aditya, K. S., and Jha, G. K. (2021). Students' perception and preference for online education in India during COVID – 19 pandemic. *Soc. Sci. Humanit. Open* 3:100101. doi: 10.1016/j.ssaho.2020.100101

Nemetz, P. L., Eager, W. M., and Limpaphayom, W. (2017). Comparative effectiveness and student choice for online and face-to-face classwork. *J. Educ. Bus.* 92, 210–219. doi: 10.1080/08832323.2017.1331990

Nikdel Teymori, A., and Fardin, M. A. (2020). COVID-19 and educational challenges: a review of the benefits of online education. *Ann. Mil. Heal. Sci. Res.* 18:e105778. doi: 10.5812/amh.105778

Pandey, D., Ogunmola, G. A., Enbeyle, W., Abdullahi, M., Pandey, B. K., and Pramanik, S. (2021). Correction to: COVID-19: a framework for effective delivering of online classes during lockdown. *Hum. Arenas* 1–15. doi: 10.1007/s42087-021-00196-0

Paudel, P. (2020). Online education: benefits, challenges and strategies during and after COVID-19 in higher education. *Int. J. Stud. Educ.* 3, 70–85. doi: 10.46328/ijonse.32

Pinto, R. (2020). *E-learning: The Advantages and Challenges.* Irvine, CA: Entrepeneur, 1–5.

Rap, S., Feldman-Maggor, Y., Aviran, E., Shvarts-Serebro, I., Easa, E., Yonai, E., et al. (2020). An applied research-based approach to support chemistry teachers during the COVID-19 pandemic. *J. Chem. Educ.* 97, 3278–3284. doi: 10.1021/acs.jchemed.0c00687

Rapanta, C., Botturi, L., Goodyear, P., Guàrdia, L., and Koole, M. (2020). Online university teaching during and after the Covid-19 crisis: refocusing teacher presence and learning activity. *Postdigital Sci. Educ.* 2, 923–945. doi: 10.1007/s42438-020-00155-y

Ribaud, V. (2020). "Scaling up a project-based SQL course," in *Proceedings of the 2020 IEEE 32nd Conference on Software Engineering Education and Training*, (Piscataway, NY: Institute of Electrical and Electronics Engineers Inc), 45–49. doi: 10.1109/CSEET49119.2020.9206199

Roach, V., and Lemasters, L. (2006). Satisfaction with online learning: a comparative descriptive study. *J. Interact.* 5, 317–332.

Roddy, C., Amiet, D. L., Chung, J., Holt, C., Shaw, L., McKenzie, S., et al. (2017). Applying best practice online learning, teaching, and support to intensive online environments: an integrative review. *Front. Educ.* 2:59. doi: 10.3389/feduc.2017.00059

Rodriguez, M. E., Guerrero-Roldan, A. E., Baneres, D., and Noguera, I. (2021). Students' perceptions of and behaviors toward cheating in online education. *Rev. Iberoam. Tecnol. del Aprendiz.* 16, 134–142. doi: 10.1109/RITA.2021.3089925

Santos, J., Figueiredo, A. S., and Vieira, M. (2019). Innovative pedagogical practices in higher education: an integrative literature review. *Nurse Educ. Today* 72, 12–17. doi: 10.1016/j.nedt.2018.10.003

Segbenya, M., Bervell, B., Minadzi, V. M., and Somuah, B. A. (2022). Modelling the perspectives of distance education students towards online learning during COVID-19 pandemic. *Smart Learn. Environ.* 9, 1–18. doi: 10.1186/s40561-022-00193-y

Selvaraj, A., Radhin, V., Ka, N., Benson, N., and Mathew, A. J. (2021). Effect of pandemic based online education on teaching and learning system. *Int. J. Educ. Dev.* 85:102444. doi: 10.1016/j.ijedudev.2021.102444

Seok, S., DaCosta, B., Kinsell, C., and Tung, C. K. (2010). COMPARISON OF INSTRUCTORS'AND STUDENTS'PERCEPTIONS OF THE EFFECTIVENESS OF ONLINE COURSES. *Q. Rev. Dist. Educ.* 11, 25–36.

Shahzad, A., Hassan, R., Aremu, A. Y., Hussain, A., and Lodhi, R. N. (2021). Effects of COVID-19 in E-learning on higher education institution students: the group comparison between male and female. *Qual. Quant.* 55, 805–826. doi: 10.1007/s11135-020-01028-z

Singh, C. K. S., Singh, T. S. M., Abdullah, N. Y., Moneyam, S., Ismail, M. R., Eng Tek, O., et al. (2020). Rethinking english language teaching through telegram, whatsapp, google classroom and zoom. *Syst. Rev. Pharm.* 11, 45–54. doi: 10.31838/srp.2020.11.9

Siripongdee, K., Pimdee, P., and Tuntiwongwanich, S. (2020). A blended learning model with IoT-based technology: effectively used when the COVID-19 pandemic? *J. Educ. Gift. Young Sci.* 8, 905–917. doi: 10.17478/JEGYS.698869

Strayer University. (2020). *Benefits of Online Learning.* Herndon, VA: Strayer University.

Suadi, S. (2021). STUDENTS' PERCEPTIONS OF THE USE OF ZOOM AND WHATSAPP IN ELT AMIDST COVID19 PANDEMIC. *Study Appl. Linguist. English Educ.* 2, 51–64. doi: 10.35961/salee.v2i01.212

Sun, A., and Chen, X. (2016). Online education and its effective practice: a research review. *J. Inf. Technol. Educ. Res.* 15, 157–190. doi: 10.28945/3502

Tarigan, R. N., Nadlifatin, R., and Subriadi, A. P. (2021). *Academic Dishonesty (Cheating) In Online Examination: A Literature Review.* Piscataway, NY: IEEE, 148–153. doi: 10.1109/ICOMITEE53461.2021.9650082

Thai, N. T. T., De Wever, B., and Valcke, M. (2017). The impact of a flipped classroom design on learning performance in higher education: looking for the best "blend" of lectures and guiding questions with feedback. *Comput. Educ.* 107, 113–126. doi: 10.1016/j.compedu.2017.01.003

Tiong, L. C. O., and Lee, H. J. (2021). E-cheating prevention measures: detection of cheating at online examinations using deep learning approach — a case study. *arXiv* [Preprint] 1–9. doi: 10.48550/arXiv.2101.09841

Tratnik, A., Urh, M., and Jereb, E. (2019). Student satisfaction with an online and a face-to-face business english course in a higher education context. *Innov. Educ. Teach. Int.* 56, 36–45. doi: 10.1080/14703297.2017.1374875

Tuparov, G., and Tuparova, D. (2021). "Gamification in higher education – a pilot study with SQL course," in *Proceedings of the 14th International Conference Education and Research in the Information Society*, Plovdiv, 81–90.

UNECSO (2020). *Education: From Disruption to Recovery.* Paris: UNESCO.

UNICEF (2020). *Education and COVID-19 – UNICEF DATA.* New York, NY: UNICEF.

Van Wart, M., Ni, A., Medina, P., Canelon, J., Kordrostami, M., Zhang, J., et al. (2020). Integrating students' perspectives about online learning: a hierarchy of factors. *Int. J. Educ. Technol. High. Educ.* 17, 1–22. doi: 10.1186/s41239-020-00229-8

Waitzberg, R., Davidovitch, N., Leibner, G., Penn, N., and Brammli-Greenberg, S. (2020). Israel's response to the COVID-19 pandemic: tailoring measures for vulnerable cultural minority populations. *Int. J. Equity Health* 19, 1–5. doi: 10.1186/s12939-020-01191-7

Wang, R., Han, J., Liu, C., and Xu, H. (2021). How do university students' perceptions of the instructor's role influence their learning outcomes and satisfaction in cloud-based virtual classrooms during the COVID-19 pandemic? *Front. Psychol.* 12:1032. doi: 10.3389/fpsyg.2021.627443

Watson, J. (2008). Blended learning : the convergence of online and face-to-face education. *North Am. Counc.* 572:16.

Wilkowski, J., Deutsch, A., and Russell, D. M. (2014). "Student skill and goal achievement in the mapping with google MOOC," in *Proceedings of the L@S 2014 – 1st ACM Conference on Learning at Scale*, (New York, NY: Association for Computing Machinery), 3–9. doi: 10.1145/2556325.2566240

Winarni, R. S., and Rasiban, L. M. (2021). Perception of Japanese students in using online video as a learning media. *Indones. J. Educ.* 1, 15–16.

Xu, B., Chen, N. S., and Chen, G. (2020). Effects of teacher role on student engagement in WeChat-based online discussion learning. *Comput. Educ.* 157:103956. doi: 10.1016/j.compedu.2020.103956

Yavuzarslan, M., Olgun, H., and Yazici, S. (2019).). A Pilot Study on the Comparison between Blended and F2F Learning Methods in a SQL Course. *Turkish Online J. Educ. Technol.* 2, 17–25.

Yosef, R., Talker, S., and Sadeh, I. (2021). Effect of covid-19 closures and distance-learning on biology research projects of high school students in Israel. *Educ. Sci.* 11:716. doi: 10.3390/educsci11110716

Yunusa, A. A., and Umar, I. N. (2021). A scoping review of critical predictive factors (CPFs) of satisfaction and perceived learning outcomes in E-learning environments. *Educ. Inf. Technol.* 26, 1223–1270. doi: 10.1007/s10639-020-10286-1

Zabaniotou, A. (2021). The COVID-19 lockdowns brought to light the challenges that women face in mediterranean universities. *Glob. Transitions* 3, 119–125. doi: 10.1016/J.GLT.2022.01.001

Zalat, M. M., Hamed, M. S., and Bolbol, S. A. (2021). The experiences, challenges, and acceptance of e-learning as a tool for teaching during the COVID-19 pandemic among university medical staff. *PLoS One* 16:e0248758. doi: 10.1371/journal.pone.0248758

Zhang, D., Zhou, L., Briggs, R. O., and Nunamaker, J. F. (2006). Instructional video in e-learning: assessing the impact of interactive video on learning effectiveness. *Inf. Manag.* 43, 15–27. doi: 10.1016/j.im.2005.01.004

Tracing writing progression in English for academic purposes: A data-driven possibility in the post-COVID era in Hong Kong

Dennis Foung[1]* and Julia Chen[2]

[1]School of Journalism, Writing and Media, The University of British Columbia, Vancouver, BC, Canada, [2]Educational Development Centre, The Hong Kong Polytechnic University, Hong Kong, Hong Kong SAR, China

It is rare to use "big data" in writing progression studies in the field of second language acquisition around the globe. The difficulty of recruiting participants for longitudinal studies often results in sample sizes that are too small for quantitative analysis. Due to the global pandemic, students began to face more academic and emotional challenges, and it became more important to track the progression of their writing across courses. This study utilizes big data in a study of over 4,500 students who took a basic English for Academic Purposes (EAP) course followed by an advanced one at a university in Hong Kong. The findings suggest that analytics studies can provide a range of insights into course design and strategic planning, including how students' language use and citation skills improve. They can also allow researchers to study the progression of students based on the level of achievement and the time elapsed between the two EAP courses. Further, studies using mega-sized datasets will be more generalizable than previous studies with smaller sample sizes. These results indicate that data-driven analytics can be a helpful approach to writing progression studies, especially in the post-COVID era.

KEYWORDS

learning analytics, progression, improvement in writing, EAP (English for academic purposes), sequential analytics

Introduction

Context and issue

Students in higher education are often required to develop their academic writing skills by taking English for Academic Purposes (EAP) courses. Undergraduate programmes usually contain several of these courses. Various studies on undergraduate students have examined their development of EAP skills and/or language usage. They often deal with improvement after taking an EAP class (Archibald, 2001; Storch, 2009; Humphreys et al., 2012) or 1 year of undergraduate study (Knoch et al., 2014; Gan et al., 2015). However, there are frequently problems with recruiting participants in

such test–retest studies, as students are usually unwilling to take tests without any benefit to themselves (Craven, 2012), resulting in the fairly limited use of mega-sized data to study the progression of literacy skills. The sample sizes of EAP progression studies range from approximately 25 (e.g., Storch, 2009) to 50 (e.g., Archibald, 2001; Humphreys et al., 2012) to just over 100 (Knoch et al., 2014). Recruitment of participants became an even more significant issue during the period of online education due to the COVID-19 pandemic. To complement their limited sample sizes, these studies often consult other data sources for further insight, such as coding academic essays (Storch, 2009; Knoch et al., 2014) and conducting student interviews (Humphreys et al., 2012; Gan et al., 2015). They have observed little improvement in students' writing skills.

There is growing demand from practitioners and administrators for the use of big data methods, such as learning analytics, in progression studies to complement existing research methods and provide insights that can inform institution/department-level decision-making and strategic planning for student success. This is important for EAP courses as students in different academic disciplines are often offered the same course. Furthermore, when students take online classes, the evidence of their learning is primarily digital; therefore, big data analytics can be employed to obtain valuable insights. Learning analytics is "the measurement, collection, analysis and reporting of data about learners and their contexts, for purposes of understanding and optimizing learning and the environments in which it occurs" (Siemens and Baker, 2012). It helps identify at-risk students and improve learning outcomes (Hyland and Wong, 2017, p. 8). However, "its use and influence in language learning and teaching have thus far been minimal" (Thomas et al., 2017, p. 197). The power of learning analytics in an EAP context was demonstrated by various scholars before the pandemic (see Foung and Chen, 2019). The current study applies an innovative analytics approach to study the progression of students' writing between two EAP courses.

The university where this study was conducted requires students to take two semester-long English language courses in their first 2 years. Local students (those from Hong Kong) take a secondary-school exit exam in English, the Hong Kong Diploma of Secondary Education (HKDSE English exam). At the research site, nearly half (49%) of the students admitted have obtained an overall Level 4 (equivalent to IELTS 6.31–6.51). While these students may not struggle with general language proficiency, they need to develop their writing skills to effectively handle university assignments (Morrison, 2014; Foung and Chen, 2019). This study explores these students' progression from their first English course, Basic EAP (EAP1), to their second course, Advanced EAP (EAP2). While EAP1 teaches basic academic English skills, such as citing sources, writing simple argumentative essays and giving academic presentations, EAP2 requires students to write longer argumentative essays and

present their research and views in a short oral defense. Since both courses include a take-home academic essay assessment and these are graded with the same set of assessment criteria, it is possible to study the progression of students' academic writing skills from the first to the second course.

Research questions

The current study aims to examine whether adopting data-driven analytics can provide useful insights to educational practitioners in the post-COVID era.

1. Did students' writing skills improve between the two courses?
2. Did the time between the courses or students' overall course grades affect the extent of students' improvement? If yes, how?
3. How did the use of learning analytics contribute to the understanding of students' writing development?

Methodology

Participants

This study adopted a convenience sampling approach. Assessment data from the university's learning management systems were retrieved for analysis, including the assessment results of 4,583 university students. Each EAP course lasts 13 weeks and meets for 3 h per week. Usually, EAP1 is taken in the first semester of Year 1. The departments in which students are enrolled can decide whether the two courses should be taken successively or with a semester or two in between.

Both EAP1 and EAP2 include an argumentative academic essay assignment. In EAP1, students are required to complete an 800-word academic essay using four sources on one of four given topics that they know well, such as education, transportation or the internet. EAP2 students are required to write a 1200-word essay that is related to an academic field, such as the use of genetic engineering or nuclear power, and incorporates a minimum of six academic sources. Each assessment is marked based on four criteria–content, organization, language and referencing–and uses the same grading descriptors (Table 1).

This study compares students' performance on this writing assignment using a data-driven approach. Since both assessments are argumentative in nature and are marked with the same set of descriptors, they are considered comparable. The center offering these courses adopts stringent quality assurance mechanisms, including standardization exercises for all teachers, double-marking for new teachers and post-assessment moderation exercises. Teachers of different sections of the

TABLE 1   Marking criteria of the take-home assessments.

Component	Criteria
Content	Task fulfilment, comprehensiveness, relevance, argumentation, etc.
Organization	Coherence, use of cohesive devices, overall structure, etc.
Language	Accuracy/range of grammatical structures, accuracy/range of vocabulary, etc.
Referencing	Acknowledgment of sources, integration of citations, etc.

course are provided with a standardized site on the university management system and a set of course notes, which they use to deliver their lessons. These procedures ensure the reliability of the current study.

Data collection procedures

Both courses use the grade center in an online learning management system to record and disseminate grades. Each essay is marked according to the four criteria (Table 1) and receives a grade for each component, in addition to an overall grade. The university has adopted a common assessment system, according to which the following grades can be given: A + , A ("outstanding"), B + , B ("good"), C + , C ("satisfactory"), D + , D ("barely adequate") and F ("inadequate"). With the help of IT colleagues, the take-home academic writing assessment grades were retrieved from the learning management system and converted to a scale of 0 to 4.5.

Unlike traditional studies, student progress was evaluated in two new ways. First, the researchers determined the number and proportion of students who earned the same grade, a lower grade and a higher grade for each assessment component. This tabulation is meaningful in view of the large sample size. They also computed the actual differences between the grades students received on the two assessments (and their effect sizes). In previous studies, such computations have not always been meaningful because their sample sizes were smaller.

For further analytics purposes, students were grouped in two ways: based on programme schedule and overall grades. In the former, students were grouped according to the time that elapsed between the two EAP courses in their degree programme. In practice, students who took EAP1 and EAP2 in two consecutive semesters were grouped together, while students who had at least one semester between the two courses formed another group. In addition, overall grades were considered. Students who achieved a grade of B (considered "good" at the university) or above in both courses were grouped together; all other students formed the second group. The semester during which students took the courses and their grades were stored in the learning management system by default and available for analysis in the current data-driven study.

Data analysis

The assessment results were subject to a series of analyses using IBM SPSS 21. Simple descriptive statistics and a paired sample t-test were used to answer the first part of RQ1. To compare the progress between the different groups, we adopted the independent sample t-test when necessary (RQ2).

Proper data cleaning procedures were applied to facilitate the use of the t-test, such as checking for normality and removing outliers. It should be noted that multiple (five) hypotheses were tested for RQ1, so the Bonferroni correction was applied to lower the alpha value from 0.05 to 0.01. Also, when examining the semester and grade factors, sample sizes between groups were unequal, so Welch's statistics were used for the independent sample t-tests.

Critics may question the validity of using a rating (ordinal) scale to run inferential statistics tests. In fact, an ordinal variable can be treated as continuous when the underlying scale is assumed to be continuous and there are more than seven categories. In the current study, the scale used for the grades on the different components can be considered continuous and there are nine categories altogether. More importantly, it is common to use a rating scale (such as IELTS band scores or the band scores of writing tests) for inferential statistics in studies of writing progression (see Storch, 2009; Knoch et al., 2014; Gan et al., 2015).

Results and discussion

Overall progression

In general, half of the students obtained a higher grade on the components of the EAP2 assessment, whereas roughly one-third received the same grade or a lower one (Table 2). It is important to note that more students received a higher grade on the skill-related components (content and referencing) than the proficiency-related components (language and organisztion).

Table 3 is an expanded version of Table 2, which presents the range of the grade changes. Overall, students demonstrated higher levels of grade increase (+ 3.0) than decrease (−2.0). The range of the grade change for "language" was the lowest

TABLE 2   Progression of students (proportion−summary).

Component	Higher grade	Same grade	Lower grade
Content	54.64%	25.31%	20.07%
Organization	51.09%	26.29%	22.67%
Language	50.90%	29.25%	19.83%
Referencing	59.25%	21.27%	19.44%
Overall	59.40%	29.96%	13.59%

TABLE 3 Progression of students (proportion).

Components	Higher grade						Same	^Lower grade			
	+ 3.0	+2.5	+ 2.0	+1.5	+ 1.0	+0.5	0	−0.5	−1.0	−1.5	−2.0
Content	0.00%	0.33%	2.16%	7.37%	17.91%	26.85%	25.31%	13.63%	5.02%	1.13%	0.28%
Organization	0.00%	0.17%	1.31%	5.82%	16.45%	27.29%	26.29%	15.82%	5.56%	1.13%	0.15%
Language	0.00%	0.00%	0.79%	4.71%	15.75%	29.67%	29.25%	14.81%	4.17%	0.85%	0.00%
Referencing	0.33%	1.13%	4.28%	9.66%	19.28%	24.61%	21.27%	12.15%	5.30%	1.59%	0.39%
Overall	0.00%	0.00%	1.20%	6.68%	19.04%	32.53%	29.96%	10.56%	2.73%	0.31%	0.00%

^No student showed a decrease of 2.5 points or more in any component.

TABLE 4 Progression of students (differences in grades).

Components	EUS-A2		AEUS-A2		Diff. in M	t (df)	Eta Squared η^2
	M	SD	M	SD			
Content	2.60	0.61	2.94	0.57	**0.33	31.15 (4579)	0.17 (Large)
Organization	2.59	0.57	2.85	0.55	**0.26	25.69 (4579)	0.13 (Medium)
Language	2.39	0.53	2.65	0.52	**0.26	28.30 (4579)	0.15 (Large)
Referencing	2.43	0.73	2.87	0.67	**0.44	35.91 (4579)	0.22 (Large)
Overall	2.49	0.54	2.88	0.51	**0.39	43.30 (4579)	0.30 (Large)

**$p < 0.01$.

of the four components (+ 2.0 to −2.0), while the range for "referencing" was the greatest (+ 3.0 to −2.0). Skill-related components featured a wider distribution (i.e., more students at the extremes) than proficiency-related components.

In addition, readers should be reminded that such analyses of range (as in Tables 3, 4) are only meaningful with a large sample size. Previous studies have often used absolute numbers to illustrate similar information to the data presented in Tables 3, 4 because using percentages to illustrate a proportion of a small sample (e.g., 30 participants) may not be very meaningful.

To understand the extent of students' improvement, paired-sample t-tests were performed to compare their scores on each component of the EAP1 and EAP2 take-home essays. The results (Table 4) show that all mean differences were statistically significant, with medium to large effect sizes. Similar to the previous observation regarding the proportion of students who improved, there was a greater difference among skill-related components (from 0.33 to 0.44) than proficiency-related components (0.26).

It is evident from the statistical analyses that students improved to different extents on the various components. Referencing was the component that showed the greatest change, while changes in language use were minimal. In fact, this is the first time that referencing (including the technicalities of citation and the proper incorporation of sources) has been measured in a writing progression study using a scale. Most previous studies were conducted in a test setting, where citing sources was not required (Knoch et al., 2014). Archibald (2001) measured referencing based on the use of concrete examples;

this definition is different from the referencing assessed in the current study. Although Storch (2009) also used coded data to explore how students used sources and paraphrasing in his progression study, he was more interested in the subtle changes in students' linguistic skills, instead of the technicalities of citation defined in this study. Therefore, the current data-driven approach provides another dimension to the analysis of progress in referencing skills (one of the key components of academic literacy) and makes the current study unique. With a holistic scale to illustrate the improvement in students' referencing skills, a more general evaluation could be made. These results will be important for course designers when considering how referencing skills should be presented in a course.

Other than referencing skills, the low degree of improvement in the "language" criterion is another interesting phenomenon. The current study was conducted using take-home assignments, but it had minimal practical differences from other studies. Without exception, past studies with test-based settings failed to find significant improvements in language (Archibald, 2001; Storch, 2009) and the current study unexpectedly echoed these findings. In the post-COVID era, language support may be deemed even more necessary, so more support should be provided to students.

The methodological difference between the current study with its big data approach and previous studies deserves further discussion. Typical progression studies compare the mean scores of different components and move on to "discourse measures," which are computed based on the linguistic features of individual students' writing (see Storch, 2009; Knoch et al., 2014). Some studies, such as Gan et al.'s (2015) study, have

TABLE 5 Progression of students (by time elapsed between the two EAP courses).

Components	2 EAPs in succession (Group A)		With >1 semester in between (Group B)		Mean difference (Group A–Group B)	df	Welch's Statistics
	M	SD	M	SD			
Content	0.31	0.73	0.41	0.73	**0.10	2230.20	16.28
Organization	0.24	0.70	0.33	0.69	**0.09	2256.42	13.49
Language	0.25	0.63	0.30	0.62	**0.05	2264.12	6.48
Referencing	0.38	0.83	0.60	0.81	**0.22	2263.00	64.58
Overall	0.37	0.62	0.46	0.53	**0.09	2319.19	23.20

**$p < 0.01$.

tabulated the extent of improvement in a detailed manner. However, with a relatively small sample size, the table could only include actual numbers, instead of percentages, to avoid misleading readers. This makes it hard for readers to interpret the extent of improvement in different components.

Also, obtaining consent to analyze students' writing can be more challenging when classes are conducted online and teachers cannot develop a trusting relationship with students *via* the computer screen. With its comparatively large sample size, the current study tabulates the different levels of improvement for each assessment component (e.g., content and organization; see Tables 3, 4), which is useful information. For example, when the proportion of students in each category is observed, the differences in the range of various components become an indicator of variation (Table 3). The greater range evident in referencing (+ 3.0 to −3.0) means there was more variation in improvement or deterioration, whereas the smaller range in language (+ 2.0 to −1.5) means less variation. Even though the use of "discourse measures" in previous studies is a valid way to quantify a student's linguistic patterns, the coding process can be time-consuming. More importantly, both the big-data approach (e.g., that of the current study) and the "discourse measures" approach lead to the same conclusion: improvement in language accuracy is minimal. This may suggest that the time-saving, big-data approach can be effective in writing progression studies.

To maximize the advantages of the big-data approach, the data were re-grouped based on when students took the courses and their overall grades. They were then used to explore if such analyses could provide insights for teaching and learning. More importantly, the following sections can illustrate the possibilities of data analytics in the post-COVID era.

Semester factor

The sample was divided into two groups: those who took the two courses consecutively ($n = 3336$) and those who took them with at least one semester in between ($n = 1244$). Table 5 illustrates the mean differences in the students' scores on the different components of the take-home writing assessments. It indicates that, on average, both groups of students showed

improvement in all components. These two datasets were then compared to find out which group of students showed more improvement.

All comparisons were statistically significant. Generally, there was a greater improvement among students who had at least one semester in between the two EAP courses than those who took them in succession. Once again, improvement was most obvious in the referencing component, with a mean difference of 0.22 points. In other words, students who took the two courses with a semester or two in between displayed a noticeably greater improvement in referencing skills than those who took the courses consecutively. The second-greatest difference was in the content component, another skill-related element. Proficiency-related components, including language and organization, revealed a smaller difference between the two groups of students. These results suggest that students who took the two courses consecutively did not improve as much as their counterparts who took them further apart.

The difference in assessment grades between students who took the two EAP subjects in succession and those who took them a semester or a year apart merits further discussion. As reflected in Table 5, students who had a "break" between the two EAP courses showed greater improvement in all four assessment components–content, organization, language and referencing–as well as their overall results, than those who did not. While all differences in the assessment scores were statistically significant, the greatest differences were associated with referencing and content. A plausible explanation for this result is that, during the "break" between the two EAP subjects, students continued to take five academic courses per semester and needed to write academic essays and reports for them. This means that they had the opportunity to practise the academic English skills they learned in the first EAP course; applying them in the context of other courses allowed them to polish these skills. During the "break" between the two EAP subjects, students may have experienced the language requirements of lecturers in other subjects (Ferris and Tagg, 1996), resulting in a deeper understanding of the instrumental relevance of EAP skills to their university studies and academic achievement.

Previous studies have rarely explored this factor. They have been more interested in how an EAP course or other intervention affects the progression of undergraduate students;

TABLE 6 Progression of students (by overall grade).

Components	Well-performing students		Average students		Mean Diff. (Out–Avg.)	df	Welch's Statistics
	Mean	SD	Mean	SD			
Content	0.37	0.69	0.32	0.74	**0.05	2539.32	4.25
Organization	0.30	0.69	0.25	0.70	**0.05	2414.96	5.80
Language	0.29	0.66	0.25	0.62	0.04	2281.92	2.81
Referencing	0.41	0.76	0.45	0.85	−0.04	2679.51	2.43
Overall	0.40	0.61	0.39	0.62	−0.01	2411.28	0.03

**$P < 0.01$.

even when they grouped students based on various factors, they often did not examine the semester during which students took the course. A traditional longitudinal design may not have been effective to analyze this factor, but it can be explored with a big-data approach, as in the current study. As previously mentioned, Craven (2012) had difficulties during the participant-recruitment process because few students were willing to take part in exams twice. If certain parameters for the participants (e.g., study patterns of English courses) are set, it will be even more difficult for traditional longitudinal studies to recruit student participants. In contrast, the current study made use of data already present in the university's learning management system, including the semesters when students took EAP courses. The advantage of having readily available data will only be intensified in the post-COVID era. Analyzing this factor was easy and effective in the current data-driven study. It has the potential to help researchers understand writing progression in the post-COVID era.

Overall grade factor

Further analyses were conducted by comparing students who received high final course grades with those who did not. Students who did consistently well in both courses (with a grade of "B" or above) were grouped as "well-performing students," whereas those who did not meet this requirement were grouped as "average students." An independent sample t-test was conducted to see if these two groups of students showed different levels of progress. Table 6 lists the mean improvement levels of both groups of students. In general, both groups of students showed improvement. The mean differences between the two groups were then computed.

Surprisingly, the well-performing students did not achieve greater improvement in all aspects, only in three out of four components. Furthermore, not all comparisons were statistically significant. In other words, even though the well-performing students received high scores in the courses in general, they did not always make significantly greater improvements than the average students. In particular, they only showed improvement that was great enough to be statistically significant in content

and organization. While both groups of students showed some improvement in referencing skills, the average students showed slightly greater improvement in this aspect; however, the difference was not statistically significant.

One further point to note is that the progression of students at all different levels of course performance was observed. Although, as expected, students in the well-performing group (i.e., students with higher overall English subject grades) improved more than their peers, our statistical analysis showed that students in the average group also made some progress, especially in the content and referencing aspects. The difference between the two groups of students' progress in terms of language use was rather minimal. This is perhaps an area that subject leaders should pay attention to–for example, by considering how EAP courses, especially the second one, can challenge students to accelerate their language development.

The results of this study may extend the understanding of the differences between students with different proficiency levels. Knoch et al. (2014) grouped the 101 students in their study into three different proficiency groups to identify differences in progression among these groups. Their comparison was mainly conducted using manually coded linguistic features, such as the use of academic words and grammatical accuracy. They found no statistically significant results related to any of the linguistic features they studied. This echoes the findings of the current study, wherein no significant difference in language improvement was observed. However, it is important to note that the participants in the current study were grouped based on overall course grades, which can be attributed to both proficiency and effort. With such consistent results, the preliminary conclusion can be reached that the proficiency of students may not necessarily play a vital role in affecting their progression. Perhaps the more important question in the post-COVID era is which other engagement or demographic factors contribute to writing progression.

Conclusion

The present study provides a new and extensive expansion of traditional progression studies and demonstrates the potential

of data analytics in the post-COVID era. With a larger sample size, the current data-driven study was able to tabulate and visualize students' progression in different areas more effectively than studies using other approaches. In addition, the present study was able to make stronger claims by using inferential statistics and employed a range of readily available variables from the university's learning management system to conduct sophisticated analyses without going through individual students' essays. This demonstrates the advantages of using learning analytics to explore students' progress. It also makes an important Contribution To The Field of second language acquisition around the globe. Data stored on learning management systems, even during online classes, can provide useful insights into the progression of their writing in the post-COVID era.

In spite of the effort to produce valid and reliable results, this study has several limitations. First, it only provides a macro picture of students' progress. Since the study advocates the use of a big-data approach, the authors did not use other methods (such as focus group interviews) to triangulate the results obtained from the quantitative data. In reality, the research site has regular QA measures that it adopts every semester (e.g., student–staff feedback meetings and questionnaires). The results of this study offer a big-data perspective to enrich the QA process. Second, the progression study presented here is based on the fact that the two assessments are highly comparable, but they are not exactly the same. One difference between this study and previous ones is that previous studies have made use of standardized tests, whereas this study examines students' progress on comparable course-based assessments. While the authors believe that differences between the assignments do not affect the validity of the study (see the Methodology section for details), the minimal differences between the assignments may limit its generalizability to a certain extent.

In light of the success of the current study, further research can take advantage of the big data era to explore students' progression in other aspects of language learning, such as speaking and reading skills, in online courses. For example, researchers can examine interactions during online classes and how students' use of language improves. This will help EAP practitioners understand the lessons learnt regarding online instruction during the pandemic and provide new insights for the post-COVID era.

Data availability statement

The datasets presented in this article are not readily available because the authors have to observe the Data Governance Framework which approved this project. Requests to access the datasets should be directed to DF, dennis.foung@gmail.com.

Ethics statement

Ethical review and approval was not required for the study involving human participants in accordance with the local legislation and institutional requirements. Written informed consent for participation was not required for this study in accordance with the national legislation and the institutional requirements.

Author contributions

Both authors planned and drafted the manuscript together.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note

All claims expressed in this article are solely those of the authors and do not necessarily represent those of their affiliated organizations, or those of the publisher, the editors and the reviewers. Any product that may be evaluated in this article, or claim that may be made by its manufacturer, is not guaranteed or endorsed by the publisher.

References

Archibald, A. (2001). Targeting L2 writing proficiencies: Instruction and areas of change in students' writing over time. *Int. J. English Stud.* 1, 153–174.

Craven, E. (2012). "The quest for IELTS Band 7.0: Investigating English language proficiency development of international students at an Australian university," in *IELTS Research Reports Volume 13*, (Melbourne: IDP), 1–61.

Ferris, D., and Tagg, T. (1996). Academic oral communication needs of EAP learners: What subject-matter instructors actually require. *TESOL Quart.* 30, 31–58. doi: 10.2307/3587606

Foung, D., and Chen, J. (2019). Disciplinary challenges in first-year writing courses: A big data study of students across disciplines at a Hong Kong university. *Asian EFL J.* 25, 113–131.

Gan, Z., Stapleton, P. A. U. L., and Yang, C. C. R. (2015). What happens to students' English after one year of English-medium course study at university? *Appl. Lang. Learn.* 25, 71–91.

Humphreys, P., Haugh, M., Fenton-Smith, B., Lobo, A., Michael, R., and Walkinshaw, I. (2012). "Tracking international students' English

proficiency over the first semester of undergraduate study," in *IELTS Research Reports Online Series*, 41. Available online at: http://gallery.mailchimp.com/d0fe9bcdc8ba233b66e1e0b95/files/Humphreys2012_ORR.pdf (accessed February 1, 2022).

Hyland, K., and Wong, L. (2017). "Faces of English language research and teaching," in *Faces of English Education*, eds L. Wong and K. Hyland (New York, NY: Routledge), 1–9.

Knoch, U., Rouhshad, A., and Storch, N. (2014). Does the writing of undergraduate ESL students develop after one year of study in an English-medium university? *Assessing Writing* 21, 1–17. doi: 10.1016/j.asw.2014.01.001

Morrison, B. (2014). Challenges faced by non-native undergraduate student writers in an English-Medium university. *Asian ESP J.* 1, 137–175.

Siemens, G., and Baker, R. S. (2012). "Learning analytics and educational data mining: towards communication and collaboration," in *Proceedings of the 2nd International Conference on Learning Analytics and Knowledge*, (New York, NY: ACM), 252–254. doi: 10.1145/2330601.2330661

Storch, N. (2009). The impact of studying in a second language (L2) medium university on the development of L2 writing. *J. Second Lang. Writing* 18, 103–118. doi: 10.1016/j.jslw.2009.02.003

Thomas, M., Reinders, H., and Gelan, A. (2017). "Learning analytics in online language learning," in *Faces of English Education*, eds L. Wong and K. Hyland (New York, NY: Routledge), 197–212. doi: 10.4324/9781315205618-13

History education done different: A collaborative interactive digital storytelling approach for remote learners

Dimitra Petousi[1], Akrivi Katifori[1,2]*, Katerina Servi[1],
Maria Roussou[2] and Yannis Ioannidis[1,2]

[1]ATHENA Research and Innovation Center, Athens, Greece, [2]Department of Informatics and
Telecommunications, National and Kapodistrian University of Athens, Athens, Greece

Social interaction has been recognized as positively affecting learning, with dialogue—as a common form of social interaction—comprising an integral part of collaborative learning. Interactive storytelling is defined as a branching narrative in which users can experience different story lines with alternative endings, depending on the choices they make at various decision points of the story plot. In this research, we aim to harness the power of dialogic practices by incorporating dialogic activities in the decision points of interactive digital storytelling experiences set in a history education context. Our objective is to explore interactive storytelling as a collaborative learning experience for remote learners, as well as its effect on promoting historical empathy. As a preliminary validation of this concept, we recorded the perspective of 14 educators, who supported the value of the specific conceptual design. Then, we recruited 15 adolescents who participated in our main study in 6 groups. They were called to experience collaboratively an interactive storytelling experience set in the Athens Ancient Agora (Market) wherein we used the story decision/branching points as incentives for dialogue. Our results suggest that this experience design can indeed support small groups of remote users, in-line with special circumstances like those of the COVID-19 pandemic, and confirm the efficacy of the approach to establish engagement and promote affect and reflection on historical content. Our contribution thus lies in proposing and validating the application of interactive digital storytelling as a dialogue-based collaborative learning experience for the education of history.

KEYWORDS

interactive storytelling (IS), dialogue, historical empathy, history education, group experience, digital experience (DX)

1. Introduction

Social interaction and social processes have been recognized as an important factor affecting learning, in general, and collaborative learning in particular (Scardamalia and Bereiter, 1991; Webb and Palincsar, 1996; van der Linden et al., 2000). Cobb and Yackel (1996) adopt a sociocultural perspective on learning that emphasizes the

importance of interactions among participants: "learning takes place in and through social interactions, as participants negotiate meanings and interpretations in search of consensual or compatible forms of understanding," assigning a key role to social interaction for the learning process. Dialogue as a tool for sociality has also been established as an end in itself (Burbules, 1993), with dialogic practices becoming an integral part of collaborative learning.

Building upon the aforementioned principles, previous work using a digital conversational agent (Petousi et al., 2021) was designed with the objective to "engage the students in constructive dialogue with each other," promoting perspective-taking and collective reflection about the past in a history education context. A rule-based bot acted as a dialogue facilitator guiding a small group of students through conversations about a variety of topics related to Ancient Athens. It followed the "bot of conviction" approach adopted by ChatÇat (Roussou et al., 2019), a "provocative" bot created for the UNESCO Neolithic site of Çatalhöyük in Turkey, and, later, applied to a collaborative learning context in the facilitated dialogue bot experience "A Discussion with Bo the Chatbot (McKinney, 2018; McKinney et al., 2020).

The ultimate aim of these experiences was to employ a more empathic attitude to history by applying the historical empathy model (Endacott and Brooks, 2013) to their design. The model aims to facilitate critical reflection and affective engagement with the past, beyond basic memorization of facts. It foresees three aspects, starting from historical contextualization as the basic learning of historical facts, moving to perspective-taking, as the understanding of the views of past people, and culminating in affective connection, i.e., prompting users to understand past people as individuals with their own emotions, values and worldview (McKinney, 2018).

In this paper, we continue along the same line of digital products applying historical reasoning (van Drie and van Boxtel, 2008) and historical thinking (Seixas, 2017) frameworks in formal and informal education; only this time we design and evaluate a web-based interactive digital storytelling application as a collaborative learning activity. Interactive storytelling is a specialization of the wider concept of digital storytelling. It is defined as a branching narrative where the user can directly influence the story plot and the characters' decisions and, in this way, create different story lines and alternative endings. To our knowledge, the potential of interactive storytelling as an incentive for dialogue has not yet been thoroughly explored and there is a concrete need to assess its validity and to identify best practices. An additional challenge that we attempt to address is to design for remote users, as the still on-going restrictions imposed by the COVID-19 pandemic highlight the need for versatile approaches to experience design.

Specifically, the objective of this work is to examine how interactive storytelling could function as a collaborative learning experience for remote users. Focusing on the story plot decision points, we seek to evaluate their effectiveness as an incentive for conversation when students are asked to experience the story together. We assess this collaborative interactive storytelling experience as a tool for the education of history, focusing on different aspects, including historical empathy, engagement, and overall user experience and the function of decision points to promote meaningful conversation. We first validate the concept through a preliminary study with history educators and then focus on assessment with students. We use a mixed methods approach, which combines qualitative and quantitative feedback obtained through observation, interviews, and questionnaires administered to the students. The study results confirm the potential of collaborative interactive storytelling combined with decision-making, revealing useful insights on its function to promote historical empathy and engagement.

In Section 2, we frame our approach with relevant work that supports our motivation. In Section 3, we present the interactive storytelling experience used in the context of this study. The study is presented in Section 4, followed by the results in Section 5. The last sections discuss our findings and conclude the paper.

2. Background

Our research draws from the areas of digital storytelling and its combination with social interaction in cultural heritage, as well as collaborative learning for the education of history.

2.1. Digital storytelling and sociality for engagement with history

Digital storytelling has long been recognized as an effective method for the communication and interpretation of the past in a cultural heritage context (Bedford, 2001), supported by several studies (Lombardo and Damiano, 2012; Pau, 2017; Poole, 2018; Roussou and Katifori, 2018) and considered a high priority for cultural institutions (Birchall and Faherty, 2016; Coerver, 2016). Applications of digital storytelling as a single-user experience for cultural heritage confirm the "strength of this approach to promote engagement, learning and deeper reflection, even for visitors with no particular interest in the specific period and themes." Narrative has shown to function as "an incentive to delve deeper into history" (Katifori et al., 2020b), while narrative elements such as "humor, links to everyday contemporary life, an informal tone, the perhaps surprising use of unconventional characters" have been deemed as important in supporting the learning objectives of informal education institutions (Roussou and Katifori, 2018). Approaches range from pre-defined narratives with varying degrees of interactivity, and balance between fiction and facts (Pau, 2017; Poole, 2018), to more dynamic and interactive experiences (Lombardo and Damiano, 2012; Katifori et al., 2019; Vrettakis et al., 2021).

Coerver (2016) discuss the importance of shifting from facts to stories that cultural heritage consumers may relate with, promoting emotions and curiosity and claim that, "what most visitors really need is a story–a memorable, emotionally resonant way to connect with a fundamentally foreign object."

Pujol et al. (2013) provide a thorough account of the importance of storytelling for cultural heritage and its effectiveness to provoke curiosity, foster engagement and promote learning. Storytelling "contributes to re-experiencing one's own heritage" (Abrahamson, 1998), while "transmitting cultural values and sanctioning what beliefs and behaviors are allowed or not" (Bruner, 1990). Bruner (1990) also describes storytelling as "the first, most essential form of human learning," promoting meaning-making through the "imaginative state" it establishes. Following the constructivist theories of learning, "stories are more easily remembered than raw facts because they contain an underlying structure and can be linked with prior experiences" (Pujol et al., 2013).

Storytelling can be characterized as "interactive" when there is at least a basic amount of user agency in relation to how the narrative unfolds. The user can directly influence the story plot and the characters' decisions through choices and, in this way, create different story lines and alternative endings. The choices, or decision points, are placed in specific and meaningful moments of the narrative, based on the premise that "story richness depends on the functional significance of each choice and the perceived completeness of choices offered" (Crawford, 2013). The term "interactive storytelling" has been used to characterize a wide spectrum of narrative types (Chrysanthi et al., 2021). Koenitz (2015) provides a thorough presentation of this diverse field, including a wide spectrum of applications: from the first text-based Interactive Fiction to such forms as Hypertext Fiction, Interactive Cinema, Interactive Installations, Interactive Drama, and Video Game Narrative. However, due to the specific challenges of the genre, very few interactive storytelling experiences have been applied to the heritage domain (Katifori et al., 2018). This research in digital interactive storytelling as a narrative type in cultural heritage has motivated us to explore its application in an educational context.

Three main types of digital storytelling have been recognized in an educational context (Robin, 2008): personal narratives, stories that inform or instruct, and stories that examine historical events. Personal narratives are stories revolving around significant life events and are usually emotionally charged and personally meaningful. Stories that inform or instruct are specific types of stories used primarily to convey instructional material in many different content areas. Stories that examine historical events recount past events from history. The Center for Digital Storytelling (University of Houston, 2022) is known for developing and disseminating a guide that describes the seven main elements of digital storytelling. These include, among others, dramatic questions that provoke curiosity, emotional content, which connects the story to the audience, and the use of multimedia, sound and music to support the story line and convey emotion. Although ours is a fictional story, its setting is historical. One of its objectives is to convey historical events and provide information about the specific setting, thus combining fiction with facts, informed by the aforementioned guide.

Robin (2008) argues that educators should use digital storytelling to support each student's unique learning capabilities and needs by encouraging them to organize and express their individual ideas and knowledge in a meaningful way. He suggests that "teacher-created digital stories may be used to enhance current lessons within a larger unit, as a way to facilitate discussion about the topics presented in a story and as a way to make abstract or conceptual content more understandable." Consequently, digital storytelling can help with the understanding of difficult or controversial historical events and topics, which is integral for reflection and understanding about human nature and society. Listening or watching a story can have a great impact as students make connections to their own lives as well as relate empathically with others after the storytelling experience. This indicates that just participating simply as a listener of stories is still an important act of negotiation and diplomacy (Mello, 2001). Gallagher (2011) justifies the use of storytelling and interpretation as critical practice for education by pointing out that during a storytelling experience we enter another's standpoint through the story, as well as the circumstances that give rise to it. Nonetheless, a theoretical model/framework for such approaches is yet to be established.

Visual Novels (VNs) are a sub-genre of interactive narratives, which offer interactive experiences where users can impact a storyline through certain actions. Cavallaro (2010), attributes the following elements in VNs. They are (1) narratively driven experiences consisting of mainly text, backgrounds, and dialogue boxes with character sprites; (2) illustrations/graphics presented to the player at central stages in the game narratives; and (3) a branching narrative with multiple endings, based on the player's choices. VNs have the potential to be used for educational purposes due to the accessibility this genre provides, with a low demand on player actions, focusing on storytelling, and role-playing / role-identification elements. According to Øygardslia et al. (2020), a key concept related to the educational properties of visual novel games is identity, as players may project their own ideas and values into the character. This means that players can identify with the character and learn from the outcomes of their choices, which are central to reflection and self-awareness. VNs can also be used to exemplify topics and promote reflection through 'defamiliarizing' the familiar. Thus VNs drawing upon historical topics and those set in contemporary or fantasy settings can create narratives that illustrate specific subjects and make them come to life, or portray current topics promoting discussion

and reflection (Øygardslia et al., 2020). There are five key dimensions for educational design and teaching strategies within Visual Novels: 1) Teaching Through Choice, 2) Teaching Through Scripted Sequences, 3) Teaching Through Mini-games, 4) Teaching Through Exploration, and 5) Non-interactive Teaching (Camingue et al., 2020). Although VNs have been used in education, so far there is no application in dialogue-based learning.

Social theories of learning (Vygotsky, 1987) emphasize the importance of social interaction, also in a storytelling context. Several projects have been developed combining sociality with digital storytelling and encouraging system-mediated conversation (Kuflik et al., 2007, 2011; Katifori et al., 2020a). The Sotto Voce project (Aoki et al., 2002), for example, as well as SFMOMA's mobile application (Pau, 2017), build upon the eavesdropping metaphor to implement sharing through a social listening experience. Other approaches combine in the same experience individual reflection parts with shared conversation or other types of social interaction (Callaway et al., 2014; Huws et al., 2018; Katifori et al., 2020a; Vayanou et al., 2021). In some cases, these approaches shift the focus from the museum expert's perspective to that of the visitors, creating a space for shared reflection and meaning-making where the expert assumes a facilitating role (Gargett, 2018; Vayanou et al., 2021). Building upon this line of research, we combine interactive storytelling with interaction points that encourage group dialogue and joint reflection. Such digital heritage experiences promoting informal learning are in line with the principles of collaborative learning, as they have been extensively discussed in literature from a more formal education perspective.

2.2. Collaborative learning and the history education

Collaborative learning is a general term, covering a range of techniques that shift the initiative and responsibility from the educator to the students. It involves students working together on activities or learning tasks in a group small enough to ensure that everyone participates. The activity can take different forms, including peer critiques, small writing groups, joint writing projects, peer tutoring, etc. Whatever the specific technique used, collaborative learning occurs when students assume more responsibility in the learning process and the material used, becoming active participants in their own education (EEF, 2021).

Scholarship differentiates between "collaborative" and "cooperative" learning. Both cooperative and collaborative learning have roots in social constructivism, and the cognitive developmental theories of Vygotsky and other scholars. Cooperative and collaborative learning are both active learning methods, in contrast to the more traditional models of education focusing on transmission of knowledge. While both approaches share a great deal in common, there are important and discernible differences (Sawyer and Obeid, 2017). Cooperative learning generally focuses on working in an interdependent fashion, where each member of the group is often responsible for a "piece" of the final product. In cooperative learning, instructors may also play a greater role in scaffolding activities by creating intentional groupings of students, or randomly assigning students to groups. Collaborative learning however, tends to feature more fluid, shifting roles, with group members crossing boundaries between different areas of work, or co-deciding the best ways to collaborate on their joint project. Goals and tasks may be more open-ended, and collaborative groups are generally more "self-managed" in terms of setting goals and establishing styles of interaction (Sawyer and Obeid, 2017). Our approach is a mixed method between cooperative and collaborative learning. We applied this mixed method approach as we considered it more suitable for following independent and interactive learning strategies based on the activity the storytelling experience provided and in this paper we use the term "collaborative" throughout.

Collaborative learning approaches have been widely used in various educational settings. Johnson and Johnson (2008) draw on their extensive experience in both the research and practical aspects of cooperative learning to draw out the factors that lead to success in academic tasks. In order for students to be involved in the learning process, five elements are necessary (Johnson and Johnson, 2008): Positive interdependence, individual and group accountability, interpersonal and small group skills, face-to-face promotive interaction, and group processing. King (2008) argues that a major challenge in implementing collaborative learning approaches is to stimulate higher thinking and learning, which requires students to go beyond mere retrieval and/or reviewing of information, to engage in analytical thinking of that information and relate it to what they already know.

Leinhardt et al. (1994) studying historical reasoning from the perspective of instructional explanations given to students, described it as "the process by which central facts (about events and structures) and concepts (themes) are arranged to build an interpretative historical case." Historical reasoning is conceptualized as an integrative and socially situated activity. Reasoning about processes of change, causes, consequences, similarities, and differences in historical phenomena and periods helps students to give meaning to the past (van Drie and van Boxtel, 2008).

The Public History Initiative of the University of California (UCLA)[1], has developed standards that include benchmarks for history and historical thinking skills, which define historical thinking in five parts: (1) Chronological Thinking, (2) Historical

---

Comprehension. (3) Historical Analysis and Interpretation, (4) Historical Research Capabilities and (5) Historical Issues-Analysis and Decision-Making. By engaging in the analysis of historical issues and relevant decision-making, the students are able to identify the interests, values, perspectives, and points of view of those involved in past events. They are also able to evaluate alternative courses of action offered to those past people, keeping in mind the information available at the time, in terms of ethical considerations, the interests of those affected by the decision, and the long- and short-term consequences of each.

Collaborative learning has been implemented on a number of occasions in history education. Steffens (1989) has put collaborative learning into action in the form of cooperative research, writing and peer review in a history seminar. Steffens has noted that student involvement and learning has increased since incorporating collaborative learning techniques into the course format. van Drie et al. (2005) have focused on how a computer supported collaborative learning (CSCL) environment elicits and supports collaborative learning, in a historical inquiry task and an argumentative essay. Another study about two cases ("StoryBase" and "Parole in Jeans") (Trentin, 2004) showed that a CSCL process can improve learning in many respects, even when collaboration takes place on-line.

The evaluation of the "Hermias, the Bot" collaborative learning experience (Petousi et al., 2021) that we developed prior to the work reported in this article confirmed that it was indeed successful in promoting a deeper, more affective, connection with history, and reflection on the past in relation to the present. The bot was designed to facilitate guided conversation between the participants on specific topics. It combined information offered by the bot with questions toward the student group interacting with it, and concluded with open, philosophical questions. Perspective-taking (PT) was by far the most prominent aspect of historical empathy evident in its evaluation sessions. The structure and content of the bot promoted open conversation on different aspects of life in ancient Athens, including social, political and religious institutions as well as everyday life practices and customs. The children exchanged opinions and ideas, taking into account the perspective of the ancient Athenians, and often compared life in the past with today.

The bot avoided offering strong personal opinions and comments, adopting a more neutral stance, to encourage students to voice their own thoughts and ideas. In this sense, the nature of the dialogue privileged perspective-taking, resulting from a more philosophical and conceptual dialogic process, rather than an affective connection that could result from a closer look at the life, emotions and thoughts of specific individuals of the past.

Inspired by collaborative learning approaches in general and dialogue-based bot experiences in particular, as well as their assessed effectiveness for promoting historical empathy for the education of history, we aim to explore alternative ways to engage students in dialogue. Our objective is to examine an approach where the participants experience and then reflect on the past through the eyes of the past people. We seek to complement the more detached and high level dialogue promoted by the bot with more affective conversation. To this end, we turn to an interactive digital storytelling design applied as a group experience and ultimately as an incentive for dialogue.

3. The interactive storytelling experience concept

For the purposes of this study we adapted an interactive storytelling experience created for an on-site visit to the archaeological site of the ancient Agora (market) of Athens (Katifori et al., 2019) using a mobile device as a guide. Additional content and instructions have been added to the story to make it suitable for off-site (online) viewing, and support its collaborative aspects.

The historical context in which this interactive storytelling experience is situated is that of Ancient Athens during the classical period (480–323 BC), a difficult period in the history of the city. Athens has been defeated in the recent Peloponnesian War and the life of many Athenians faces a deep crisis due to the aftermath of the war. Wealthy citizens of Athens have faced financial ruin. Thus, the story becomes an incentive for deeper reflection on issues very much relevant also to today: the financial crisis and its implications, ethical, political and social issues of distribution of wealth, and more personal issues of coping in times of crisis.

The main character of the story is Hermias, a slave. Slavery in ancient Athens is a controversial institution for a city known as the "cradle of Democracy." The divide between free citizens and slaves seems to be a simplistic view of this society and there are gaps in our knowledge. Hence, this theme offers an opportunity for interesting historical fiction. Hermias experiences concerns and feelings that are valid and current also today, including financial insecurity, personal fear for the future of the individual and their family and loved ones, feelings of trust, or lack of, toward others, etc.

The story unfolds in a sequence of scenes with conversation between its characters, combined with brief narration segments situating the conversation in time and space. Decision points are available at the end of each scene, allowing the user to control how the story continues. The user experiences the story from the perspective of the main character, instructed to make choices in his stead (Figure 1).

The interactive storytelling experience features 7 decision points at each story path and 15 alternative endings defined by combinations of these decision points. To address the issue of "functional significance" (Crawford, 2013) of the choices, some of the decision points are decisive about how the story unfolds later on. For example, already at the start of the experience, the

FIGURE 1
Example of a story scene.

user is asked to decide whether the main character should wear or not his protective amulet, which has been with him since he was a child. Another example of a decision point is the following:

Soon a beautiful woman accompanied by her slave approaches. Her eyes meet yours. She stops and addresses you…
– You are distressed. You need to talk to someone. And this woman seems very nice…

– You don't want to speak with anybody. Even more with this stranger approaching with a smile…

Other decision points are of a more ethical or emotional nature and are designed to provoke reflection rather than having any functional significance (Figure 2).

At three points in the story, especially after segments where specific, possibly unknown, historical concepts and terms are used, there is informational content available in the form of

FIGURE 2
Decision point of an affective nature.
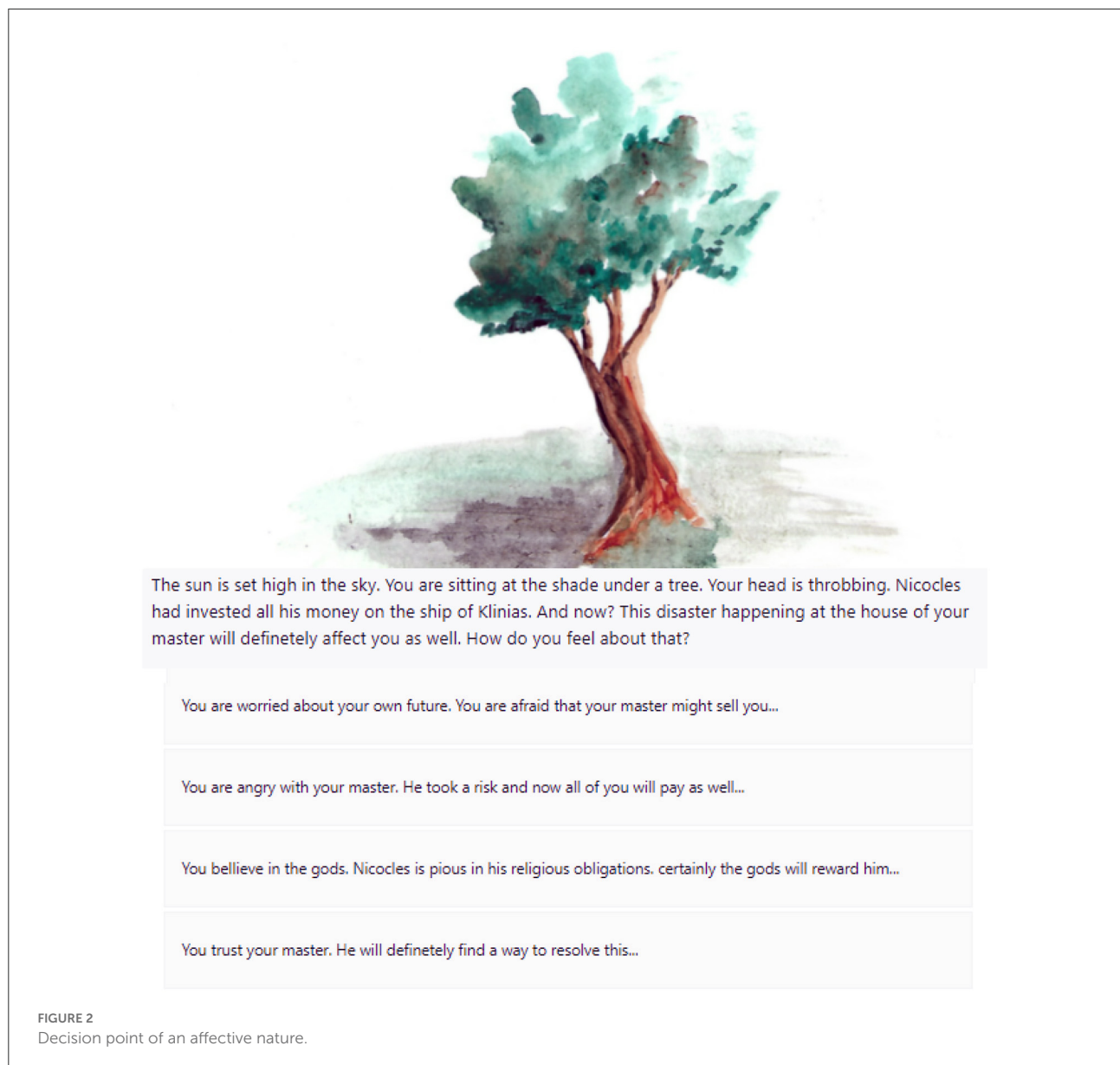
questions and answers. Examples include: "What is Tholos? What is the Peloponnesian War? What is the exposure of infants?" In the end, there is the possibility to find out what happened to the main characters after the conclusion of the story.

The endings present different outcomes for the main character, some more favorable than others, depending on the users' choices. One of the endings leads to an "anticlimax" as, sometimes, that can also occur in real life.

The interactive experience has been implemented as a web-based multimedia application using the authoring tool for digital interactive storytelling presented in Vrettakis et al. (2019, 2020). The users follow the story as a series of simple web pages. Each dialogue scene is presented with an image and audio of the dialogue. The dialogue text is also available on screen. The choices available to the user are presented as list type menus. By clicking on an option, the corresponding page opens. The users have the possibility to go back and revisit already viewed scenes or change their choices. The web application is optimized for ease of use and simplicity, minimizing any cognitive load resulting from having to learn a more complex application. Being a branching narrative, with choices available at the plot level but also access to informational content, the experience does not have a fixed time duration. A minimum duration for a single user, where spending time with peers on conversation about choices is not required, is estimated at 17–18 min; a maximum duration, if all choices are viewed, can go up to about 21–22 min.

4. Study

In this section we present the study objectives and articulate our research questions. We attempt a first validation of these questions from the perspective of the educators by collecting feedback through an on-line questionnaire. This pre-study confirms the potential of this research direction, as perceived by the educators. We then present the details of a study design where teenagers are called to experience the interactive storytelling as a collaborative activity and provide their feedback. We report on the evaluation methods, participants, process, and data analysis.

4.1. Study objectives and research questions

The main objective of this study is to assess the effectiveness of interactive storytelling, and its combination with dialogue between participants, as a collaborative learning tool to promote historical empathy. To this end, we focus on the following research questions:

- RQ1 - Does interactive storytelling as a collaborative dialogic activity provoke curiosity and engagement with the specific historical context?
- RQ2 - How is the joint decision-making process at the story plot decision points perceived by the students?
- RQ3 - Is the dialogue activity at the storytelling decision points effective in promoting historical empathy in general and affective connection in particular?
- RQ4 - Can the collaborative experience function effectively when the participants are not collocated?

In the next section, we briefly present the results of the preliminary validation of our concept with 14 educators. We then move on to the description of the main study design with 15 teenage participants.

4.2. Pre-study validation of the research objectives with educators

Before moving forward in organizing the main study to assess the efficacy of our approach with adolescents, we distributed a questionnaire addressed to educators, to record their insights and perspective. Through an open call that was distributed to adult researchers, faculty members, and personal acquaintances, we sought secondary education educators with experience in the teaching of history. The individuals who agreed to participate were sent the relevant consent form, the

TABLE 1 Pre-study with educators: questionnaire results for statements 1-8 (score in *Completely disagree (1)* to *Completely agree (5)* on the Likert scale).

Statement	Average and standard deviation
1. Interactive storytelling as a group experience can enrich history education.	Av = 4.57, STD = 0.51
2. Interactive storytelling can become an incentive for dialogue about the past in the classroom.	Av = 4.71, STD = 0.47
3. Interactive storytelling can become the incentive for dialogue about the connection of the past with the present.	Av = 4.64, STD = 0.63
4. The plot of the interactive storytelling can appeal to teens.	Av = 3.85, STD = 0.69
5. The design and aesthetics of an interactive story (illustration / voice acting / sound effects) can appeal to teens.	Av = 3.43, STD = 1.09
6. The students can benefit from the inclusion of the specific interactive storytelling experience in the curriculum.	Av = 4.50, STD = 0.65
7. The curriculum may benefit from the inclusion of this type of "informal" dialogic education experience.	Av = 4.21, STD = 1.05
8. The students would feel that this experience would be a waste of time for their studies.	Av = 1.71, STD = 1.14

link to the interactive storytelling experience, and an online questionnaire to fill in anonymously after the experience.

Fourteen middle and high school educators participated in the preliminary study, 12 women and 2 men, 28–65 years old. They were all experienced in the teaching of history in different classes in secondary education. They were sent instructions on how to view the experience as well as a description on how the story's decision points could be used as an impetus for conversation and joint decision-making between the adolescents.

The questionnaire (see Supplementary material: Questionnaire for educators) includes 11 questions and an additional field for open comments. Questions 1–8 consists of statements that the participants score on a 1–5 Likert scale, from *Completely disagree* to *Completely agree*. The results are summarized in Table 1.

As indicated by the results, the educators were very positive about the concept of interactive storytelling as a dialogic experience. In their comments some noted that the experience could be combined with a session of dialogue in class, engaging the whole class together and further elaborating on the topics relevant to the experience. When asked what in their opinion would be the most effective use of the experience, the majority (ten participants) responded "As a group activity of 2–3

students," two selected "As an activity for the whole class together," one "As an individual experience" and one "As a group experience with the group size defined by the available equipment, with two being the optimum number." Four of the participants noted that this type of guided dialogic process may be particularly beneficial in helping participants to develop soft skills such as engaging in dialogue, exchanging opinions, and joint decision-making.

In relation to the topics that they would like an interactive story to highlight in this context, "Everyday life in antiquity" was the most prominent one, with 10 responses. As three of the participants noted in their comments, this aspect is "less pronounced and highlighted" in the textbooks and such an approach "would promote a closer perspective to the life of the people of the past". Topics such as social inequality, slavery, and the position of women in the past and in comparison with today were also mentioned by several of the participants as important to include in the story concept.

Having confirmed that our concept for a collaborative interactive storytelling experience was meaningful to the participating history educators, we proceeded with our study design with students.

4.3. Study design and instruments

To explore the study research questions, we organized a user study with teenage participants. They were invited to experience in small groups, remotely, the interactive digital storytelling described in Section 3. We collected their feedback using a mixed methods approach, adapted from Petousi et al. (2021) to collect data. The data we collected combined:

(a) Observation of the participants during the experience. For each group we recorded the duration of the dialogue segments as well as the dialogue content itself, combined with possible non-verbal cues conveying emotions, such as laughter.
(b) A post-experience individual questionnaire (see Supplementary material: Questionnaire for students). This questionnaire has been adapted from studies attempting to record user engagement and historical empathy in digital storytelling experiences (Katifori et al., 2020a; Petousi et al., 2021). It is composed of two main parts, aimed to record (a) the participant profile (6 questions) and (b) the student's perspective for the experience (25 questions).
(c) A focus group discussion with each of the participant groups, guided by a list of 7 questions (see Supplementary material: Interview questions guide).

The aforementioned questionnaire, interview, and observation data were designed to support our research questions by recording three main categories of findings:

1. Those related to User Experience, denoted with the prefix UX in the results section. For general participant engagement with the digital storytelling application we took into account UX aspects, measuring its pragmatic qualities ("ease of use") and hedonic qualities ("joy of use") (Merčun and Žumer, 2017);
2. Those related to interactivity, denoted with IN. In this context "interactivity" refers to the function of the digital storytelling as an interactive, branching narrative, providing to the users the possibility to choose the direction the story unfolds at key decision points;
3. Those related to historical empathy, noted with the relevant prefix for each of its three aspects, namely historical contextualization (HC), perspective-taking (PT), and affective connection (AC); and
4. Those related to decision-making (DM) and consensus (RC). Specifically, which perspective is considered during decision-making (the character's, the user's, the historical context, etc.) and how easily the group reached consensus during decision-making.

These are presented in detail in Table 2.

As the specific historical period is included in the Greek education curriculum, we expected that the participants would have basic pre-existing knowledge. Before the start of the experience and to establish a baseline, the participants were asked a few questions in relation to the topics, including "What do you know about the status of slaves in ancient Athens?". Also, indirect questions like "did you learn something new today?" were included in the post-experience interview. Although in this study we focus more on affective connection and perspective-taking, through these questions, we attempt to consolidate the participant's self-perceived learning outcomes to assess the effect of the experience on historical contextualization.

4.4. Participants and procedure

Originally this study had been designed for collocated users, i.e. a group of students positioned in front of the same screen. However, the on-going safety measures imposed during the COVID-19 pandemic highlighted the need for effective educational activities to support remote teaching. So instead of having the teenagers co-located, we adapted the experience and process to conduct the evaluation sessions remotely, using a teleconference platform with screen sharing functionality. One of the group members was designated to use the storytelling application and would also screen share for others to watch the story as well.

Participants in this study included 15 junior high and high school students, 10 girls and 5 boys between the ages of 13 and 17. Members in each group knew each other, either as

TABLE 2 Dialogue analysis criteria.

Objectives	Criteria
HC - Historical contextualization	HC1 - Learning of individual historical facts
	HC2 - Understanding facts in their wider historical context
	HC3 - Understanding that different views and values of past people may have been influenced by the historical context
PT - Perspective taking	PT1 - Appreciation of alternative beliefs, practices, values, etc.
	PT2 - Considering a topic from different perspectives
	PT3 - Expressing a shift in personal opinions, values, or attitudes
AC - Affective connection	AC1 - Feeling connected to the people of the past
	AC2 - Connecting the past to personal experiences
	AC3 - Connecting the past with issues of the world today
	AC4 - Feeling or expressing emotions about the people of the past
UX - User Experience	UX1 - Pragmatic qualities - Usability
	UX2 - Hedonic qualities - Engagement
	UX3 - Hedonic qualities - Fun
RC - Reaching consensus	RC1 - Immediate agreement
	RC2 - Agreement after discussion
DM - Decision-making	DM1 - Based on the perspective of the characters
	DM2 - Based on the perspective of the user
	DM3 - Strategic decision - what would produce the best outcome for the story
	DM4 - Based on the historical context

classmates or friends. The groups had the following composition (participant names have been substituted with pseudonyms):

- G1: Alan (boy aged 15), Nathan (boy aged 15)
- G2: Damien (boy aged 13), Gina (girl aged 13), Rebecca (girl aged 13)
- G3: Erica (girl aged 15), Marissa (girl aged 15), Naya (girl aged 16)
- G4: Michael (boy aged 14), Nigel (boy aged 14)
- G5: Anne (girl aged 16), Diana (girl aged 17), Mona (girl aged 17), Mayra (girl aged 16), Nellie (girl aged 17).

All participants in this study were volunteers and were recruited via an open call through email to participate in the study, disseminated by the authors to parents and educators. The purpose of the study was stated in the invitation. We

invited volunteers to participate in small groups of 2–5 teenagers who were familiar with each other, so conversations could be more informal and rich since the children would feel more comfortable to talk. An information sheet and a consent form were given to the children's guardians containing information about procedures, voluntary participation and contact information of the researchers. The participants were not rewarded or incentivized in any way. The guardians were asked to sign the consent form a few days before each evaluation session. The evaluators then set up the evaluation session at an arranged date and time. Before the start of each session, the evaluators briefly introduced the process and then asked participants to assign the member of the group who would control the storytelling application. Then the evaluators retreated with their cameras in off mode and their microphones muted to observe discreetly and respond if any issue or query arose. The sessions were recorded, with the participants' and their guardians' permission, while the evaluators kept notes throughout each session. At the end of the session, participants were engaged together in a brief focus group discussion about the experience (see Supplementary material: Interview questions guide) and were asked to fill in the questionnaire individually (see Supplementary material: Questionnaire for students).

This study has been approved by the National Kapodistrian University of Athens' ethics committee.

4.5. Data analysis

The questionnaire results were collected and for each statement we calculated the average score and relevant standard deviation.

Two researchers segmented and analyzed independently the dialogue transcripts for each group. The analysis was based on the codes as defined in Table 2. After working separately for each transcript, reaching an 82% inter-reliability score, they met to identify the points where there were differences between their coding and jointly discussed those points to reach a common decision.

The duration of each dialogue segment for each group has also been calculated, including average duration and standard deviation per segment.

The interview responses were analyzed in conjunction with the questionnaire results in order to provide a deeper understanding of the participants' perspective.

5. Results

In this section we present the combined results of the analysis of the study questionnaire, interviews and participant

TABLE 3 Questionnaire results for statements related to engagement (score in *Completely disagree (1)* to *Completely agree (5)* on the Likert scale).

	Statement	Average and standard deviation
S2	I felt that time passed quickly during the experience. (UX)	Av = 4.15, STD = 0.9
S3	I would recommend this experience to others. (UX)	Av = 4.23, STD = 1.01
S4	I liked the plot of the story. (UX)	Av = 4.15, STD = 1.07
S5	I liked the illustrations in the story. (UX)	Av = 3.69, STD = 1.32
S6	The characters of the story seemed realistic. (UX)	Av = 4.0, STD = 0.58
S7	At some points I felt anxious about how the story would unfold. (UX)	Av = 3.69, STD = 1.25
S8	At some points I wished the story had a specific ending. (UX)	Av = 3.69, STD = 1.38
S9	I had the impression that I could directly affect the story plot. (IN)	Av = 4.0, STD = 0.71
S12	I would have liked this story to be linear (without choices). (IN)	Av = 1.69, STD = 1.03

TABLE 4 Duration of conversation (total and per decision point) and total of the experience.

Decision point (DP)	Average	STD	G1	G2	G3	G4	G5
DP1	0′47″	0′24″	0′20″	0′41″	0′32″	1′04″	1′19″
DP2	0′44″	0′25″	0′37″	0′45″	0′33″	0′20″	1′27″
DP3	0′48″	0′14″	0′43″	0′50″	1′10″	0′32″	0′43″
DP4	1′09″	0′17″	0′71″	1′02″	1′27″	0′44″	1′21″
DP5	1′	0′38″	0′40″	1′41″	1′40″	0′21″	0′39″
DP6	1′22″	0′42″	1′10″	2′25″	1′32″	1′16″	0′28″
DP7	1′29″	1′35″	1′40″	4′10″	0′41″	0′22″	0′31″
Conversation total	7′19″	1′36″	6′21″	12′34″	8′35″	5′39″	6′27″
Experience total	25′33″	1′38″	26′03″	28′07″	29′16″	24′11″	20′08″

observation, focusing on the four research questions, as presented in Section 4.

5.1. RQ1-Engagement

Our first research question explored the effect of social interactive storytelling on engagement: "RQ1 - Does interactive storytelling as a collaborative dialogic activity provoke curiosity and engagement with the specific historical context?"

The study results reveal that the overall experience has indeed been engaging and effective in its UX hedonic aspects. The relevant questionnaire responses scored an average of close to or greater than 4, as shown in Table 3. The children consistently found the experience "interesting" (77%), "pleasant" (77%) and "original" (62%) and, in some cases, "realistic" (31%) and humorous (31%) (Statement 1–S1). They particularly liked the story plot and characters (S4 and S6) and their perceived sense that the story duration was short (S2) is indicative of general engagement and confirmed by the observed elements of fun, laughter, and captivation in all sessions.

The actual average experience duration, as shown in Table 4, lasted more than 25 min, with the average conversation duration being approximately 7 min long. This indicates that the experience was successful in captivating the children's attention and promoting conversation.

When asked during the interview about what they generally liked or disliked, most teenagers commented that they "really
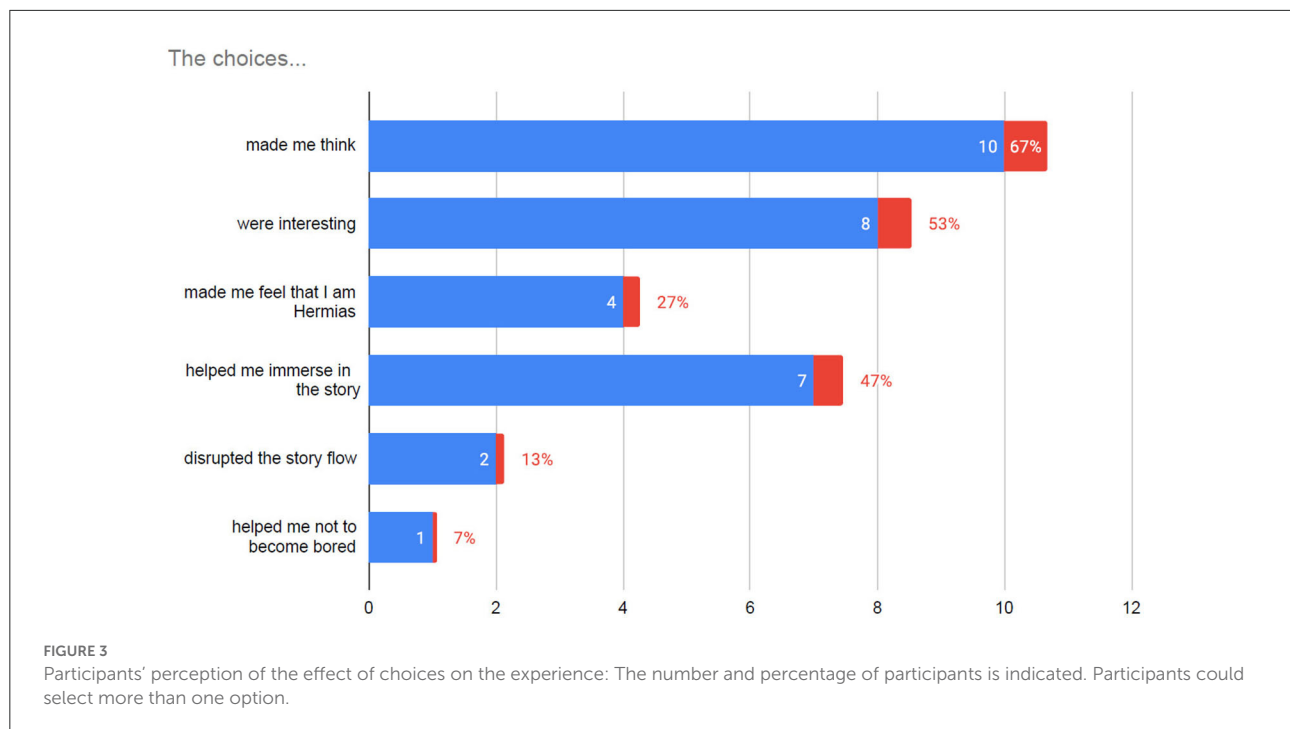
liked" the experience and that "there was nothing bad or negative. Rebecca (G2) added: *"I like everything about it, the whole combination of things."* and Nathan (G1) commented: *"It is extremely innovative and can contribute to the entertainment of the user."* The fact that the story scenes were presented through dialogue seemed to be particularly appreciated. *"I really liked the dialogue,"* Michael (G4) commented, and Naya (G3) noted: *"The dialogues added some kind of depth to the experience. I am not sure how to explain it. We heard the characters talking in a natural, everyday way. It was not like reading a textbook about the past."*

The fact that the experience was a branching narrative was discussed spontaneously by 3 out of 5 groups during the interview as one of its strongest points. Marissa (G3) mentioned *"I liked that we were able to choose."* And, as Nathan (G1) commented, also confirming the need for functional significance of the choices: *"I liked that our choices could lead to a different ending. They were valid ones, you knew your choice matters."* Some participants, like Alan (G1), even thought that it would be nice to be offered even more choices.

The interview results are confirmed by the relevant questionnaire statements (Table 3), showing that the participants felt that to a certain extent they could control the story plot and would not have liked the story to be linear. Figure 3 summarizes their responses as to how they would characterize the existence of choices in the narrative. *"They made me think"* was the most prominent choice, followed by *"they helped immerse me in the story"* and *"they were interesting."*

5.2. RQ2-Decision-making

In this section we present the results of our second research question: "RQ2 - How is the joint decision-making process at the story plot decision points perceived by the students?"

FIGURE 3
Participants' perception of the effect of choices on the experience: The number and percentage of participants is indicated. Participants could select more than one option.

The collaborative nature of the experience was welcomed by the children, as the average score of questionnaire statement S21 *"I would have liked to experience this story by myself"* implies (Av = 2.08, STD = 1.26). Only one of the participants, Michael (G4), felt that he would prefer to view it alone. He was in G4 with only one other participant. Their interactions were brief, reaching consensus quickly. In the interview Michael clarified: *"I would prefer to do it alone, or otherwise, with more people, 3 to 4, not just one. In this case it would be useful to be able to have some type of voting system when we need to choose."* Voting was also suggested by Anne (G5).

All participants felt that they did make joint decisions after discussing the available choices, based on the relevant questionnaire statements (100% "Yes" in S22 *"We made joint decisions for the story within my group."* and 100% "Yes" in S23 *"We discussed it within the group before making a choice."*) Table 4 confirms that at each decision point there was indeed a conversation between users, ranging from 20 s to more than 4 min.

The way decisions were made was characterized as "effective" (77%), "collaborative" (62%) and "pleasant" (46%) in the relevant questionnaire statement (S24). Similarly, their perceived sense of participation in the dialogue (S25 *"I felt that I participated in the decision-making process."*) was particularly high (Av = 4.54, STD = 0.52).

The questionnaire results are supported by the relevant interview questions, with the participants providing more in-depth views about the dialogic process. Two were the main arguments in favor of collaborative decision making. Firstly, some participants felt that discussing and deciding together helped them to examine the choice from different perspectives, to consider all aspects, and to make an informed decision leading to the best outcome. Nathan (G1) commented: *"Most probably, to our understanding, the ending was positive. Maybe if we had made different choices it would not be. And the group decision led to the best choices, exactly because you can listen to the opinions and views of different people, it leads to an objective choice. In the end you don't rely only on what you would do but on what would be the best choice at that moment."* Naya (G3) added a different perspective mentioning that *"If I had been alone it would never end, I would not know what to decide. I think doing this together helped me organize my thoughts, focus on the story and somehow it did not break the story flow."* A similar thought was voiced by Nellie (G5).

Alan (G1) and Erica (G3) were also among those who explicitly classify the value of discussing the choices as *"very positive"* and as a *"way to see different perspectives, ultimately leading to your own perspective possibly changing."* And, as Damien (G2) argued, *"if we had been alone it would not have been as interactive and fun."*

All groups felt that they made the optimum decisions according to the circumstances. Some of them attempted to trace back on how the choices affected the positive outcome. Naya (G3) wondered: *"I understood that our decision to wear the amulet in the beginning did play a significant role. I wonder what would happen if we had decided not to. The same with talking to Galatea. How would this have affected the ending? I am convinced*

we made the right choices but I would like to see what would be the alternative outcomes."

Observed behavior within the groups revealed that indeed in the majority of the cases there was discussion between the participants before reaching consensus for the choice. An average of 4.4 incidents per group (STD = 1.14) reached consensus directly (RC1) vs. 2.6 (STD = 1.14) who reached consensus after discussion (RC2). Independently of agreeing or not, the teenagers still conversed and commented before making the choice (see selected transcripts in Supplementary material: Dialogue transcripts). Some decision points seemed to provoke conversation more than others, as shown in Table 4, and there were also differences noted between the groups. An example is the last decision point (DP7), ranging in conversation duration from 21 s to 4 min and 10 s. At DP1 all the groups chose to wear the amulet, although some considered reasons why not to. As a result, up to DP5, where the main character, Hermias, decides whether to talk to Galatea or not, the story plot is similar in all groups, except for G2 who decide not to talk to her. In all cases the group self-facilitated the dialogue, with the group member handling the application implicitly also assuming this role and making sure all members had expressed their opinion.

In terms of the decision-making perspective, the most prominent one was DM1 with an average of 4.4 per group (STD = 2.19). Although the participants attempted to make choices keeping the perspective of the main character in mind, it was inevitable that they were also influenced by their own perspective (DM2: Av = 2.4, STD = 3.05) and their understanding of the historical context (DM4: Av = 0.4 STD = 0.55), as well as the attempt to optimize the story outcome (DM3: Av = 1, STD = 1). As an example, in DP6 the students had to decide whether Hermias should react or not when being sold by his Master. In this case they felt that they should take into account who he is and his circumstances, and felt that it would not be realistic to react. As Naya (G3) discusses *"We preferred realism when making decisions, trying to stay close to how things would happen at that period."* There were cases where these perspectives were mixed, switching for example from DM2 to DM1. As Damien (G2) mentioned while discussing whether to wear the pendant or not, *"I would wear it. Since he believes it can protect him it might be helpful later on."*

5.3. RQ3-Historical empathy

The main objective of the collaborative storytelling experience was to give participants the necessary material and the appropriate motivation to develop historical empathy. Our third research question revolved around this concept: "RQ3 - Is the dialogue activity at the storytelling decision points effective in promoting historical empathy in general and affective connection in particular?" As the previous sections also reveal, the combination of storytelling with interactivity and

dialogue seemed indeed to promote a more affective stance on the past. A closer examination of the combined results of the study provides insight as to how the experience has affected each of the different aspects of historical empathy, namely historical contextualization, perspective taking and affective connection.

Historical contextualization in our case refers to the degree of learning historical facts and understanding them in their wider context. Our focus in this study has been on the affective connection aspects of historical empathy; to this end we did not attempt to measure learning in a strictly quantitative way, by examining the participant's knowledge in depth before and after the experience.

An observed behavior at the three factual information branching points available, was that, although the users could choose to read more about specific topics, like the Peloponnesian War, they rarely chose more than one topic. They briefly scanned them and discussed what they already knew and what not, and selected one of the unknown ones to view, before moving on with the story. As some of the groups mentioned, and we also observed during the experience, there was a concern that focusing too much on the information would *"break the story flow"* (Rebecca - G2). In this sense, the children did not engage much with the offered factual information.

However, the participants' perceived sense of learning as indicated by the questionnaire results (Table 5) was high. The students felt that they learned something new (S13), their opinion about ancient Athens changed (S14), and they also felt inspired to learn more about it (S15). The interview analysis confirms that the students during the experience deepened their understanding of specific concepts and institutions that they already knew about, like the division of classes in ancient Athens, the institution of slavery, religion, etc. This was evident during the conversation between the children and also from their responses during the interview, especially on the question of *"How would you describe the life of a slave in ancient Athens?"* Most of the groups felt that the issue of slaves was more complex than they had expected. An interesting perspective was offered by G1. According to Nathan: *"There are many factors to consider, but I believe now that the most important one is who your master is. If it is a person who means well, they will not treat you as a slave, an object, but as something more. We saw this contrast in the behavior of Nicocles and Eukrates. Eukrates saw Hermias as an object, not as a human being, he was cruel. Nicocles, on the other hand, had raised him as his own son."* And Alan adds: *"Don't forget also the period and regime. At the golden age of Athens and the democracy, the life of slaves must have been better, not so hard. But at this period, after the big war and with the economic crisis… for sure their life must have been affected. Nicocles had to sell Hermias because he went bankrupt."*

The ability of the experience to promote perspective-taking through dialogue has indeed been appreciated by the participants as a strong point. Evidence of examining a topic from different perspectives and considering new ideas is

Questionnaire results for statements related to historical empathy (score in *Completely disagree (1)* to *Completely agree (5)* on the Likert scale).

	Statement	Average and standard deviation
(S13)	The experience helped me learn something new. (HC)	Av = 3.46, STD = 0.97
(S14)	The experience changed my opinion about the people of ancient Athens (HC)	Av = 3.62, STD = 1.45
(S15)	am now inspired to want to learn more about ancient Athens and its inhabitants. (HC)	Av = 3.54, STD = 1.13
S16	The experience brought the past to life for me. (AC)	Av = 3.5, STD = 1
S17	The experience made me reflect on topics that don't normally concern me and to process new ideas. (PT)	Av = 3.46, STD = 1.05
S18	I saw the past through the perspective of the people of that time. (PT)	Av = 4.08, STD = 0.95
S19	I identified with some of the characters. (AC)	Av = 3.15, STD = 1.07
S20	I felt that the life and dilemmas of the characters have common points with my own life. (AC)	Av = 3.0, STD = 1.29

consistently observed in all groups (PT2: Av = 1.8, STD = 1.1) and confirmed by the questionnaire results (S17). Similarly, the students felt that they were able to see the past through the eyes of its people (S18).

The teenagers during the interview reported that they enjoyed watching the story unfold through a first person perspective, *"through the eyes of a slave and not the master: we saw the past from the perspective of the lowest class"* (Erica - G3). The sense of realism resulting from listening to everyday dialogues also seemed to support a more closer and personal perspective. This direct view through the eyes of the main characters, in combination with the conversation at the decision points, seemed to actually induce various degrees of affective connection in all groups. *"Feeling or expressing emotions about the people of the past"* (AC4), was consistently recorded in all groups (Av = 3.2, STD = 1.3), followed by *"Connecting the past with issues of the world today"* (AC3: Av = 1.8, STD = 1.8). As the dialogue analysis revealed, they seemed to understand that the past people's knowledge, beliefs and values may have differed from ours, and that people's intentions and goals may be personal or complex. They seemed to recognize that past actions can be perceived as actions that have hidden motives and relate to things not in an obvious and direct way.

As discussed in Section 5.2, during the decision-making process, the adolescents attempted to reconcile their own personal and emotional perspective on how they or the main character should react, with the historical context dictating what the most realistic reaction would be. As Naya (G3) explained, about the decision on how Hermias should react when his new

master is verbally abusive: *"From our perspective, if someone did this to us, we would certainly talk back to them. However, we needed to consider that in that period and for his social class, the consequences would be grave for him if he did so. The division of classes then was very different than today. We had to take this into account."*

The affective aspect of the experience is indicated also by the way the children describe Hermias and the other characters during the interview: *"I liked Hermias. He was not a toxic and sarcastic person. He was nice, and you could see that immediately."* Gina (G2) comments. And Damien adds *"Yes, and also communicative and social, he was not shy."*

To conclude, the collaborative decision-making task in the interactive storytelling context was indeed successful in promoting historical empathy with a strong affective element, with the first person perspective being particularly enjoyable. As Nathan (G1) comments, *"I would like to see more stories with the perspective of different social classes: a common citizen, an aristocrat, a politician, or even a soldier. It would also be very interesting to see the life of younger people, children of different social classes, through mini-stories in different time periods and places."*

5.4. RQ4-Effectiveness as a remote teaching activity

In terms of our fourth research question, "RQ4 - Can the collaborative experience function effectively when the participants are not collocated?", the outcomes of the study are positive. Section 5.1 discusses the overall student engagement, as it has been observed and also reported by the students. Taking into account that the children are already accustomed with teleconferencing platforms and remote teaching due to the pandemic, they were familiar with the medium and adapted quickly to the process. The experience flowed naturally between the narrative segments and the dialogue activities, and the children enjoyed their participation in the dialogue and the collaborative decision making, as discussed in Section 5.2.

An additional feature in favor of the remote setting in comparison to the collocated one is the possibility for the educator to have a more discreet supervising presence during the experience. In the teleconferencing system the educator may switch off the microphone and camera and remain "invisible," allowing the students to feel more comfortable and engage in the conversation more freely. During the evaluation sessions, as the experience progressed and the teenagers became captivated by the story and dialogue, they seemed to quickly forget the presence of the evaluators. They seemed immersed in the group experience, relaxed and engaged often in humorous remarks. Although a targeted study is needed to examine the effect of the physical presence of the educator in a collocated study, the results are by themselves very positive for the remote setting.

On the whole, taking into account the positive outcomes of the study in response to our research questions, we can conclude that this experience design has great potential to be effective as a remote teaching tool.

6. Discussion and limitations

In this paper we focus on assessing the potential of interactive digital storytelling as a means for collaborative learning in history education. The story decision points become the incentive for reflection and dialogue between small groups of students, enhancing the engagement already established with the use of storytelling as a medium. We apply this approach in a remote teaching context, proposing, however, a design that could easily be adapted to a collocated one. This approach allows for flexibility that has been shown to be necessary during the trying times of the pandemic. Our study sample is not large, however the results already confirm that the collaborative experience can indeed engage the participants in meaningful dialogue. Even though it was their first encounter with such an activity, all groups were engaged in a dialogic process that was smooth and respectful.

This research falls within the theoretical approaches highlighting the notion of dialogue as an education practice. Dialogue takes place to support the collaborative decision-making process during the decision points in the interactive storytelling. We argue that this enactment of collaborative decision-making may be successfully operationalised through the connection between the interactive digital storytelling (motivating listening skills) and the implementation of dialogue (motivating social skills) and collaborative decision making (motivating cooperation skills) (Kirbaş, 2017). The experience employs dialogue, argumentation, and cooperation as means to achieve perspective-taking and historical empathy.

Fisher (2013) also developed practical ways to enhance the dialogic learning practice in the classroom. His approach revolves around six consecutive stages of dialogic assessment: listening, responding, engagement, participation, dialogic skills, and understanding, combined with a list of success criteria with a description of evidence of different levels of engagement (Fisher, 2013). Fisher's framework highlights the necessity of the aforementioned dialogic approach for advancing children's learning through discussion. It is an approach that explores strategies that can be used to help learners talk in pairs and groups, solve problems with others and talk together in practice. Fisher argues that by talking together in groups, children can learn how to think widely and deeply, learn collaboratively as part of a group, develop dialogic skills, and practice social and cooperative skills. This can increase learners' self-awareness and autonomy. Although we didn't apply Fisher's framework in our analysis, we observed that participants reached different stages, particularly the first 3 (listening, responding, and

engagement) during the storytelling part, and the 4th stage (participation) during the decision points. In the future we plan to integrate Fisher's framework in our evaluation approach further to investigate the potential of collaborative decision-making through storytelling and the level of engagement in the dialogue it can trigger.

Since dialogue can function as a non-content-exclusive, non-context-specific versatile approach, it can be used across many subjects in a curriculum, i.e., dialogic approaches can be implemented in the learning of a second language. Long and Porter (1985) provide a psycholinguistic rationale for group work and dialogue that supports second language acquisition. They have identified the following aspects in group-work interlanguage talk that increases second language acquisition: quantity and variety of practice, correction, negotiation and clear two-way tasks. The research findings on interlanguage talk and group work support the claims for increases in the variety of language practice. Provided careful attention is paid to the structure of tasks students work on together, the negotiation work possible in group activity makes it an attractive alternative to the teacher-led, "lockstep" mode and a viable classroom substitute for individual conversations with native speakers. However, an important factor is the recipient, since Long and Porter (1985) highlight the importance of recognizing the difference in processes around acquisition for children and adults.

The effectiveness of the use of interactive storytelling as an incentive for decision-making dialogue hints at its potential beyond the development of historical empathy and reasoning. The participants engaged in a positive dialogic experience and had the chance to exercise their argumentation skills in a controlled and safe setting. This activity of exchanging opinions and reaching the best possible outcome created a positive sense of accomplishment. The potential of assuming another's perspective has already been widely discussed in the context of educational role playing games (Petousi et al., 2022). According to Daniau (2016), assuming the perspective of another gives the participants the chance to remember this character's experiences more vividly, as if they have happened to them, in a form of personal storytelling (Bowman, 2017). This activity promotes understanding of others' unique points of view, and allows users to practice social-emotional learning (SEL) (Hammer et al., 2018), including creativity, collaboration, and team building (Daniau, 2016) and better understand their reality (Bowman, 2010; Zalka, 2012).

Taking into account the study results and the insight of the educators participating in the preliminary study, we believe that collaborative interactive storytelling can similarly be employed for the development of soft skills, including engagement in dialogue, reasoning, perspective-taking and decision-making. Further studies, targeted to this specific objective, are needed.

An important aspect to be considered when organizing such activities is that discreet supervision of the children is

necessary at all times, even though it may affect engagement with the experience and the ease that the students feel while conversing. The supervisor should ensure that the dialogue remains respectful and that no biases or false assumptions are introduced. Even though the educators may not intervene directly at that time, they need to be able to detect any misconception or bias so as to plan afterwards to address it with an additional activity in class. The proposed design, having the students and educators participating remotely, supports this discreet supervision, as the educators have the possibility to observe almost unseen in the teleconferencing system, if they keep their camera and microphone off.

When designing such a collaborative learning activity, balancing the narrative with the appropriate amount of decision points is key for a cohesive and engaging storytelling. Narration and giving historical information can help students understand the context of the historical event; however, without decision points that help shape the narrative, the story won't be very engaging or immersive. Striking the right balance between following a narration and the decision points which can be used as a motivation for discussion and perspective taking, is what makes for an impactful story. However, it is hard to define this balance of how many decision points are too many or too little. The ratio between narration and decision points can be solely defined by a combination of different factors, such as the type of the story, the length, its setting, its message, its educational aim, the number of participants etc. These interaction points should definitely serve concrete educational objectives.

Furthermore, the right balance between storytelling and historical information can make the story both credible and compelling. In our case extra historical information was provided in between the major plot points of the story, in the forms of questions. Although we noticed participants did not choose any questions about historical facts, they seemed to be eager to learn at a later time. Their main reason was not to break the immersion on the plot of the story. However, it could be interesting to investigate their behavior regarding this part, if the information was presented to them as helpful in order to advance the plot.

Group size is a factor that has not been thoroughly explored in this study. Our groups ranged from two to five participants, and conversation ensued in all cases. However, our insight from this small sample is that a group size of 3–4 people is optimum for this type of activity: with two participants sometimes there is no disagreement to push forward the conversation and with more than four, some participants may not get the chance to express their opinion fully. As future work, it would be interesting to repeat the study in a wider sample, adequately comparing between different group sizes.

This further research, along with exploring the effect of group dynamics, is needed to produce relevant guidelines. As an example, a relevant research question is whether this experience would be as effective for groups of children who are not already familiar with each other, to support informal education contexts such as the design of museum activities, where different families wish to enroll their children during the visit.

As the study results reveal, the children were able to empathize with the characters and reason about choices and opportunities of the hero from the past. In this sense, the experience has indeed been successful to a degree, in promoting emotional and cognitive empathy and helping the children reflect on the conditions of others and people of the past. All participants seemed to have fun with the whole process, learning through the perspective of people of the past. The majority of the students who participated gave reasonable and valid arguments for their preferred choices and, in addition to opinions, also expressed emotions about the characters. However, an important aspect that requires further research, not included in this work, are the long term effects of the experience. A more longitudinal approach would be interesting to reveal these aspects: the long-term gain of soft skills, effects of memory, satisfaction, and enjoyment. Some longitudinal studies of the long-term impact of museum exhibits have been conducted by Falk (2006), who sent a questionnaire to visitors a few weeks after their visit in a science center. Falk (2006) have found that cognitive and affective changes can be sustained after a period of the visit, if the museum experience is reinforcing personal relevance to the visitor. The understanding of the long-term impact of storytelling and collaborative experiences enables a better understanding of how to design and enrich the content of such applications. Although we did not specifically record the participants prior experience with similar types of interactive storytelling, from the general commentary of the participants during the interview it becomes evident that they are not familiar with the use of such an approach to promote dialogue. To this end, it would be important to examine the same research questions once the novelty factor is no longer in effect, after the adolescents become more accustomed to this type of educational activity. It would be interesting to investigate the various aspects (narrative, collaboration, content or media such as images, sound effects, etc.) that play a strong role in attracting and engaging users and making the experience more meaningful, memorable, inspiring, and personally satisfying for them.

7. Conclusion

In this work we present the findings of a user study on the effectiveness of a collaborative interactive digital storytelling experience as an activity for the remote teaching of history. Prompted by the need to provide alternatives to collocated activities during the difficult and on-going period of the COVID-19 pandemic, we decided to experiment with an approach that fosters social interaction and meaningful communication through dialogue, both significantly impeded due to the need for

social distancing. The design is meant to be versatile, and can applied as needed in both contexts, collocated and remote.

In a nutshell, our findings suggest that:

- The overall experience has indeed been engaging, with the branching narrative and dialogue points commented positively by the adolescents as important contributing features.
- The collaborative nature of the experience was welcomed by the children, focusing on the effectiveness of joint decision making to reach the optimum outcome. The children combined different perspectives to reach consensus during the decision-making process.
- The combination of storytelling with interactivity and dialogue seemed indeed to promote a more affective stance toward the past, with its various features supporting all three aspects of historical empathy—historical contextualization, perspective taking and affective connection.
- The experience ran smoothly as a remote experience, with the added bonus that the educator's supervision is less conspicuous in this setting, possibly contributing to the children feeling more at ease to express their opinions in the dialogue.

Our concept of using interactive storytelling with meaningful decision points as an incentive for conversation was welcomed by educators as an in-class activity, either for collocated or for remote teaching. The students participating in the study also confirmed the potential of the approach, as our results reveal. We thus conclude that the combination of interactive storytelling and collaborative decision-making merits further research to understand its full potential and function for historical empathy and beyond. We aim to continue our research in this domain with more targeted studies, exploring how factors such as group size and group dynamics may affect the overall experience. Our aim is to compile useful guidelines for the design of storytelling-based collaborative learning experiences that can be effective in both collocated and remote contexts.

Data availability statement

The original contributions presented in the study are included in the article/Supplementary material, further inquiries can be directed to the corresponding author.

Ethics statement

The studies involving human participants were reviewed and approved by Ethics Committee of the Department of Informatics and Telecommunications and the Research Ethics Committee (E.H.D.E.) of the National and Kapodistrian University of Athens. Written informed consent to participate in this study was provided by the participants' legal guardian/next of kin.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note

All claims expressed in this article are solely those of the authors and do not necessarily represent those of their affiliated organizations, or those of the publisher, the editors and the reviewers. Any product that may be evaluated in this article, or claim that may be made by its manufacturer, is not guaranteed or endorsed by the publisher.

Supplementary material

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/feduc.2022.942834/full#supplementary-material

References

Abrahamson, C. E. (1998). Storytelling as a pedagogical tool in higher education. *Education* 118, 440–451.

Aoki, P. M., Grinter, R. E., Hurst, A., Szymanski, M. H., Thornton, J. D., and Woodruff, A. (2002). "Sotto voce: exploring the interplay of conversation and mobile audio spaces," in *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems, Changing our World, Changing Ourselves-CHI '02* (New York, NY: ACM Press), 431–438.

Bedford, L. (2001). Storytelling: the real work of museums. *Curator* 44, 27–34. doi: 10.1111/j.2151-6952.2001.tb00027.x

Birchall, D., and Faherty, A. (2016). "Big and slow: adventures in digital storytelling," in *MW2016: Museums and the Web 2016* (Los Angeles, CA).

Bowman, S. L. (2010). *The Functions of Role-Playing Games: How Participants Create Community, Solve Problems and Explore Identity, 1st Edn*. Jefferson, NC: McFarland & Company.

Bowman, S. L. (2017). Active Imagination, Individuation, and Roleplaying Narratives. Tríade: Revista de Comunicação, Cultura E Midia 5, 158–173. Available online at: https://www.academia.edu/39536022/Active_Imagination_Individuation_and_Role_playing_Narratives

Bruner, J. S. (1990). *Acts of Meaning*. Cambridge, MA: Harvard University Press.

Burbules, N. C. (1993). *Dialogue in Teaching: Theory and Practice (Advances in Contemporary Educational Thought Series)*. New York, NY: Teachers College Press.

Callaway, C., Stock, O., and Dekoven, E. (2014). Experiments with mobile drama in an instrumented museum for inducing conversation in small groups. *ACM Trans. Interact. Intell. Syst.* 4, 1–39. doi: 10.1145/2584250

Camingue, J., Melcer, E. F., and Carstensdottir, E. (2020). "A (visual) novel route to learning: A taxonomy of teaching strategies in visual novels," in *International Conference on the Foundations of Digital Games* (Bugibba: FDG '20), 1–13. doi: 10.1145/3402942.3403004

Cavallaro, D. (2010). *Anime and the Visual Novel: Narrative Structure, Design and Play at the Crossroads of Animation and Computer Games*. Jefferson, NC: McFarland and Company.

Chrysanthi, A., Katifori, A., Vayanou, M., and Antoniou, A. (2021). "Place-based digital storytelling. the interplay between narrative forms and the cultural heritage space," in *Emerging Technologies and the Digital Transformation of Museums and Heritage Sites, First International Conference, RISE IMET 2021* (Nicosia: Springer), 127–138.

Cobb, P., and Yackel, E. (1996). Constructivist, emergent, and sociocultural perspectives in the context of developmental research. *Educ. Psychol.* 31, 175–190. doi: 10.1080/00461520.1996.9653265

Coerver, C. (2016). On (Digital) Content Strategy. Available online at: https://www.sfmoma.org/read/on-digital-content-strategy/ (accessed July 19, 2022).

Crawford, C. (2013). "Interactive storytelling," in *The Video Game Theory Reader, 2nd Edn*, eds M. J. Wolf and B. Perron (Milton Park: Routledge), 259–273.

Daniau, S. (2016). The transformative potential of role-playing games–: from play skills to human skills. *Simulat. Gaming* 47, 423–444. doi: 10.1177/1046878116650765

EEF (2021). *Collaborative learning approaches: High impact for very low cost based on limited evidence*. Technical report, The Education Endowment Foundation.

Endacott, J., and Brooks, S. (2013). An updated theoretical and practical model for promoting historical empathy. *Soc. Stud. Res. Pract.* 8, 41–58. doi: 10.1108/SSRP-01-2013-B0003

Falk, J. H. (2006). *Understanding Museum Visitors' Motivations and Learning*. Denmark: Agency for Culture and Palaces, Danish Ministry of Culture. 106–127. Available online at: https://slks.dk/fileadmin/user_upload/dokumenter/KS/institutioner/museer/Indsatsomraader/Brugerundersoegelse/Artikler/John_Falk_Understanding_museum_visitors__motivations_and_learning.pdf

Fisher, R. (2013). *Creative Dialogue: Talk for Thinking in the Classroom, 1st Edn*. Oxfordshire, UK: Routledge.

Gallagher, K. M. (2011). In search of a theoretical basis for storytelling in education research: story as method. *Int. J. Res. Method Educ.* 34, 49–61. doi: 10.1080/1743727X.2011.552308

Gargett, K. (2018). *Re-thinking the guided tour: co-creation, dialogue and practices of facilitation at York Minster* (Ma thesis). University of York.

Hammer, J., To, A., Schrier, K., Bowman, S. L., and Kaufman, G. (2018). "Learning and role-playing games," in *Role-Playing Game Studies* (Routledge, NY: Routledge), 283–299.

Huws, S., John, A., and Kidd, J. (2018). "Evaluating the affective dimensions of traces-olion: a subtle mob at st fagans national museum of history, wales," in *Digital Heritage International Congress/VSMM 2018* (San Francisco, CA), 1–8.

Johnson, D. W., and Johnson, R. T. (2008). "Social interdependence theory and cooperative learning: the teacher's role," in *The Teacher's Role in Implementing Cooperative Learning in the Classroom* (Boston, MA: Springer US), 9–37.

Katifori, A., Karvounis, M., Kourtis, V., Perry, S., Roussou, M., and Ioanidis, Y. (2018). "Applying interactive storytelling in cultural heritage: opportunities, challenges and lessons learned," in *Interactive Storytelling. ICIDS 2018. Lecture Notes in Computer Science, Vol. 11318*, eds R. Rouse, H. Koenitz, and M. Haahr (Cham: Springer), 603–612.

Katifori, A., Perry, S., Vayanou, M., Antoniou, A., Ioannidis, I.-P., McKinney, S., et al. (2020a). "Let them talk!": exploring guided group interaction in digital storytelling experiences. *J. Comput. Cultural Heritage* 13, 1–30. doi: 10.1145/3382773

Katifori, A., Roussou, M., Kaklopoulou, I., and Servi, K. (2019). "Mobile interactive storytelling in the Athens Ancient Agora: exploring the right balance between the Site and the App," in *XVII. Culture and Computer Science* (Berlin), 47–60.

Katifori, A., Tsitou, F., Pichou, M., Kourtis, V., Papoulias, E., Ioannidis, Y., et al. (2020b). "Exploring the potential of visually-rich animated digital storytelling for cultural heritage: the mobile experience of the athens university history museum," in *Visual Computing in Cultural Heritage*, eds F. Liarokapis, N. Doulamis, A. Doulamis, and A. Voulodimos (Cham: Springer Nature), 325–345.

King, A. (2008). Collaborative learning in the music studio. *Music Educ. Res.* 10, 423–438. doi: 10.1080/14613800802280167

Kirbaş, A. (2017). Effects of cooperative learning method on the development of listening comprehension and listening skills. *Int. J. Lang. Educ.* 1, 1–17. doi: 10.18298/ijlet.1712

Koenitz, H. (2015). "Towards a specific theory of interactive digital narrative," in *Interactive Digital Narrative*, eds H. Koenitz, G. Ferri, M. Haahr, D. Sezen, and T. B. Sezen (New York, NY: Routledge), 91–105.

Kuflik, T., Sheidin, J., Jbara, S., Goren-Bar, D., Soffer, P., Stock, O., et al. (2007). "Supporting small groups in the museum by context-aware communication services," in *Proceedings of the 12th international conference on Intelligent user interfaces-IUI '07* (New York, NY: ACM Press), 305.

Kuflik, T., Stock, O., Zancanaro, M., Gorfinkel, A., Jbara, S., Kats, S., et al. (2011). A visitor's guide in an active museum. *ACM J. Comput. Cult. Heritage* 3, 1–25. doi: 10.1145/1921614.1921618

Leinhardt, G., Stainton, C., Virji, S. M., and Odoroff, E. (1994). "Learning to reason in history: mindlessness to mindfulness," in *Cognitive and Instructional Processes in History and the Social Sciences, 1st Edn*, eds M. Carretero and J. F. Voss (Routledge), 131–158.

Lombardo, V., and Damiano, R. (2012). Storytelling on mobile devices for cultural heritage. *New Rev. Hypermedia Multimedia* 18, 11–35. doi: 10.1080/13614568.2012.617846

Long, M. H., and Porter, P. A. (1985). Group work, interlanguage talk, and second language acquisition. *TESOL Q.* 19, 207–228. doi: 10.2307/3586827

McKinney, S. (2018). *Generating pre-historical empathy in classrooms: an examination of a digital classroom kit* (M.Sc. in digital heritage). University of York.

McKinney, S., Perry, S., Katifori, A., and Kourtis, V. (2020). "Developing digital archaeology for young people: a model for fostering empathy and dialogue in formal and informal learning environments," in *Communicating the Past in the Digital Age: Proceedings of the International Conference on Digital Methods in Teaching and Learning in Archaeology (12th-13th October 2018)*, number August (London: Ubiquity Press), 179–195.

Mello, R. (2001). The power of storytelling: how oral narrative influences children's relationships in classrooms. *Int. J. Educ. Arts* 2. Available online at: http://www.ijea.org/v2n1/ (accessed July 19, 2022).

Merčun, T., and Žumer, M. (2017). Exploring the influences on pragmatic and hedonic aspects of user experience. *Inf. Res.* 22, 1621. Available online at: http://informationr.net/ir/22-1/colis/colis1621.html (accessed July 19, 2022).

Øygardslia, K., Weitze, C. L., and Shin, J. (2020). *The educational potential of visual novel games: Principles for design. Replay. Japan 2*, 123–134. Available online at: https://www.researchgate.net/publication/341380379

Pau, S. (2017). "Audio that moves you: experiments with location-aware storytelling in the SFMOMA app," in *MW17: Museums and the Web 2017* (Cleveland, OH|: Archives Museum Informatics).

Petousi, D., Katifori, A., Chrysanthi, A., Servi, K., Sakellariadis, P., and Ioannidis, Y. (2022). "Role playing games as hybrid museum kits promoting historical understanding and meaning making," in *AVI-CH 2022 Workshop on Advanced Visual Interfaces for Cultural Heritage co-located with 2022 International Conference on Advanced Visual Interfaces (AVI 2022)* (Frascati, IT).

Petousi, D., Katifori, A., McKinney, S., Perry, S., Roussou, M., and Ioannidis, Y. (2021). "Social bots of conviction as dialogue facilitators for history education: promoting historical empathy in teens through dialogue," in *Interaction Design and Children* (New York, NY: ACM), 326–337.

Poole, S. (2018). Ghosts in the Garden: locative gameplay and historical interpretation from below#. *Int. J. Heritage Stud.* 24, 300–314. doi: 10.1080/13527258.2017.1347887

Pujol, L., Roussou, M., Poulou, S., Balet, O., Vayanou, M., and Ioannidis, Y. (2013). "Personalizing interactive digital storytelling in archaeological museums: the CHESS project," in *Archaeology in the Digital Era. Papers from the 40th Annual Conference of Computer Applications and Quantitative Methods in Archaeology (CAA)*, eds G. Earl, T. Sly, A. Chrysanthi, P. Murrieta-Flores, C. Papadopoulos, I. Romanowska, and D. Wheatley (Southampton, UK: Amsterdam University Press) 77–90.

Robin, B. R. (2008). Digital storytelling: a powerful technology tool for the 21st century classroom. *Theory Pract.* 47, 220–228. doi: 10.1080/00405840802153916

Roussou, M., and Katifori, A. (2018). Flow, staging, wayfinding, personalization: evaluating user experience with mobile museum narratives. *Multimodal Technol. Interact.* 2, 32. doi: 10.3390/mti2020032

Roussou, M., Perry, S., Katifori, A., Vassos, S., Tzouganatou, A., and McKinney, S. (2019). "Transformation through provocation? designing a 'bot of conviction' to challenge conceptions and evoke critical reflection," in *CHI 2019: ACM CHI Conference on Human Factors in Computing Systems, Paper 627* (Glasgow).

Sawyer, J., and Obeid, R. (2017). "Cooperative and collaborative learning: Getting the best of both words," in *How We Teach Now: The GSTA Guide to Student-Centered Teaching*, eds R. E. Obeid, A. E. Schwartz, C. E. Shane-Simpson, and P. J. Brooks (Society for the Teaching of Psychology), 163–177. Available online at: http://teachpsych.org/ebooks/

Scardamalia, M., and Bereiter, C. (1991). Higher levels of agency for children in knowledge building: a challenge for the design of new knowledge media. *J. Learn. Sci.* 1, 37–68. doi: 10.1207/s15327809jls0101_3

Seixas, P. (2017). A model of historical thinking. *Educ. Philos. Theory* 49, 593–605. doi: 10.1080/00131857.2015.1101363

Steffens, H. (1989). Collaborative learning in a history seminar. *Hist. Teacher.* 22, 125–138. doi: 10.2307/493967

Trentin, G. (2004). Networked collaborative learning in the study of modern history and literature. *Comput. Hum.* 38, 299–315. doi: 10.1007/s10579-004-1110-8

University of Houston (2022). *Educational uses of Digital Storytelling.* Technical report, University of Houston Education.

van der Linden, J., Erkens, G., Schmidt, H., and Renshaw, P. (2000). "Collaborative learning," in *New Learning* (Dordrecht: Springer Netherlands), 37–54.

van Drie, J., and van Boxtel, C. (2008). Historical reasoning: towards a framework for analyzing students' reasoning about the past. *Educ. Psychol. Rev.* 20, 87–110. doi: 10.1007/s10648-007-9056-1

van Drie, J., van Boxtel, C., Erkens, G., and Kanselaar, G. (2005). Using representational tools to support historical reasoning in computer-supported collaborative learning. *Technol. Pedagogy Educ.* 14, 25–41. doi: 10.1080/14759390500 200191

Vayanou, M., Katifori, A., and Ioannidis, Y. (2021). Perspective sharing in culture group games: passing around the social mediator role. *Proc. ACM Hum. Comput. Interact.* 5, 1–24. doi: 10.1145/3474676

Vrettakis, E., Katifori, A., and Ioannidis, Y. (2021). "Digital storytelling and social interaction in cultural heritage - an approach for sites with reduced connectivity," in *Interactive Storytelling. ICIDS 2021. Lecture Notes in Computer Science, Vol. 13138*, eds A. Mitchell and M. Vosmeer (Cham: Springer), 157–171.

Vrettakis, E., Kourtis, V., Katifori, A., Karvounis, M., Lougiakis, C., and Ioannidis, Y. (2019). Narralive - Creating and experiencing mobile digital storytelling in cultural heritage. *Digit. Appl. Archaeol. Cultural Heritage* 15, e00114. doi: 10.1016/j.daach.2019.e00114

Vrettakis, E., Lougiakis, C., Katifori, A., Kourtis, V., Christoforidis, S., Karvounis, M., et al. (2020). "The story maker-an authoring tool for multimedia-rich interactive narratives," in *Interactive Storytelling. ICIDS 2020. Lecture Notes in Computer Science, vol. 12497*, eds A. Bosser, D. Millard, and C. Hargood (Cham: Springer), 349–352.

Vygotsky, L. S. (1987). "Thinking and speech," in *The Collected Works of Lev S. Vygotsky, Vol. 1*, eds R. W. Rieber and A. S. Carton (New York, NY: Plenum Press), 39–285.

Webb, N. M., and Palincsar, A. S. (1996). "Group processes in the classroom," in *Handbook of Educational Psychology*, eds D. C. Berliner and C. R. Calfee (Hoboken, NJ: Macmillan Library Reference USA; Prentice Hall International), 841–873.

Zalka, C. V. (2012). *Adventures in the Classroom Creating Role- Playing Games Based on Traditional Stories for the High School Curriculum* (Master of arts in reading with a concentration in storytelling). East Tennessee State University.

Frontiers in Education

English language learning in response to the COVID-19 pandemic: Hong Kong English as a Second Language students' perceptions of Badaboom!

Frankie Har*

English Language Centre, The Hong Kong Polytechnic University, Hong Kong, Hong Kong SAR, China

In the midst of COVID-19 pandemic, many university courses delivered in English are conducted entirely online. However, if we continue using traditional teaching strategies and the same set of teaching materials, it would be extremely difficult for students, regardless of age, to focus in a 2- or 3-h synchronous online class. As such, many researchers and educators are exploring different ways to engage students in today's digitally connected world. This article explores how English as a Second Language (ESL) undergraduate students come up with emergency remote learning at The Hong Kong Polytechnic University during the COVID-19 pandemic. Using exploratory research design, one hundred university students from five English for Academic Purpose (EAP) classes who experienced blended learning using Badaboom!, a Game-based Student Response System (GSRS), for one semester were recruited to participate in the research. 30 students were interviewed to collect the data. The interview aimed to detail their responses so their strategies can be mapped clearly. The data reveal that the tertiary-level learners of this study feel that game-based classroom response system is useful for assisting them in overcoming ESL academic writing difficulties. The study reflects that, most students favour the interactivity and engagement afforded by Badaboom! due to the strong instructor-student and student-student interaction as well as students' increased engagement.

Introduction

As mobile technology has become more widely used in today's classroom, educators are now able to enlist digital games to teach and learn. Classroom interaction used to take place using traditional student response systems (SRS), also known as "clickers" (Caldwell, 2007). Over the past few years, game mechanics have been integrated into traditional SRS resulting in Game-based Student Response System (GSRS). The use of GSRS is booming today, including Kahoot (Ulla et al., 2020; Kohnke and Moorhouse, 2021), Quizlet (Azman et al., 2018), Socrative (Kaya and Balta, 2016), and Mentimeter (Moorhouse and Kohnke, 2020). Multi-device interactions are possible through these interactive technologies, including laptops, smartphones, and tablets. Based on the design and processes of digital games, GSRS fosters an atmosphere of friendly competition in the classroom, thereby creating a pleasant classroom atmosphere. Gee (2005) claims that digital games are learning devices, and they can be an attractive addition to many classroom environments, allowing students to become even more motivated, engaged, and motivated to learn. Students can gain traction with GSRS by leveraging the many motivational factors such as leaderboards, leader badges, badges of achievement, reward points, and instant feedback loops, which encourage players to engage with educational content in a playful and dynamic manner.

The game-based classroom response system "Badaboom!" is modelled after the popular gamified quiz app Kahoot! and incorporates different gaming elements, such as rules, competitions, timing, rewards, and feedback through interactions with students. The introduction to Badaboom! in a blended classroom could be considered an innovation practice because it requires both teachers and students to be facilitators in a virtual classroom context. Furthermore, Badaboom! allows students to choose between more than four answer options before selecting the best one. Additionally, Badaboom! has an innovative option for numeric questions and answers and free handwriting, math, and symbol responses, which cannot be found in some other GSRSs like Kahoot, Socrative, and Mentimeter (see **Figure 1**). It is possible for students to respond by handwriting freely on their mobile phones, tablets, or laptops. In order for this to be possible, users can automatically transform their free handwriting into typed LaTeX by using automatic handwriting recognition technology. More importantly, the word clouds in Badaboom! system can show the words that are most frequent in free text and handwritten responses as well as the responses that are represented in LaTeX. Although Badaboom! was launched by the Hong Kong Polytechnic University in 2019, the application was mainly integrated in STEM subjects including

science, technology, engineering and mathematics. The use of this tool in the language classroom has yet to be fully explored as to how it can be beneficial to EAP students. Therefore, the purpose of this study was to examine how undergraduate students' perceptions of the incorporation of Badaboom!, a GSRS, into a blended EAP learning environment.

Paedagogical framework and paedagogical principles

Game-based learning

Learning today is characterised by the use of an array of instructional strategies, games and technologies, all of which are being used to cater the needs of diverse learners. As game-based learning technology continues to develop and become more mainstream, there are a number of positive ramifications for learning. Furthermore, it is equally important that the learners are motivated and engaged at a much higher level than before in order to change their behavioural and mindset patterns in a lasting manner. Hence, a major concern in formal education is to immerse students throughout the lessons. According to Ting et al. (2019), game-based learning uses game applications that have explicit learning goals to combine aspects of experiential learning with intrinsic motivation, allowing learners to engage in complex problem-solving tasks and activities that closely resemble real-world situations. Game-based learning has radically changed learners' preferences and learning abilities. This learning approach should be used to develop students' thinking skills, problem solving abilities, and independence.

Paedagogical framework for digital game-based learning

In this section, the paedagogical framework for digital game-based learning by applying Malone's Intrinsic Motivation Model (1981) will be examined. As Malone perceives it, learning is fun when players are challenged with problem-solving tasks in an environment where they are surrounded by audio-visual stimuli. He identifies three factors that significantly affect intrinsic motivation: the "challenge," the "fantasy," and the "curiosity" (see **Figure 2**). Goals with uncertain outcomes are thought to be the source of challenge. For instance, the level of difficulty can vary, multiple levels of goals can be set, there can be randomness and the feedback can be customised. Malone (1981) argues that self-esteem increases when players are not only challenged but are successful in overcoming the obstacle. Players who create fantasy environments in their competitive circumstances often imagine themselves in a way
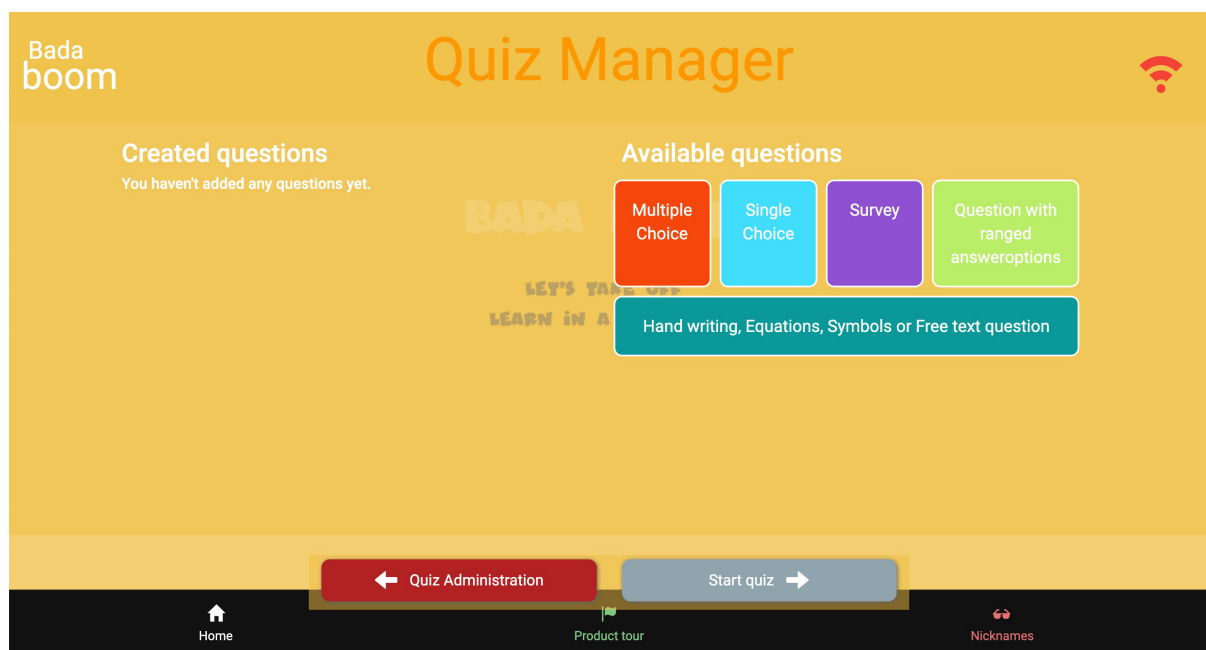
FIGURE 1
Hand-writing function in Badaboom! (http://palms.polyu.edu.hk/).
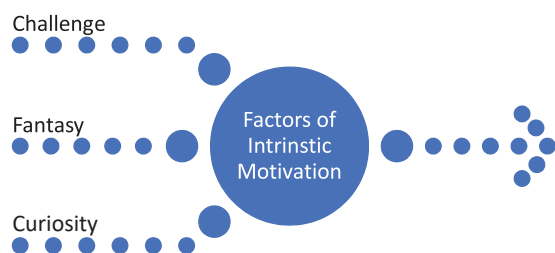

FIGURE 2
Modified conceptual map of Malone's Intrinsic Motivation Model (1981).

which is meaningful to them. Fantasy is a major pillar of digital games that often addresses the emotional needs of learners, thereby helping connect the new learning with their schematic knowledge. In contrast, the curiosity is the driving force behind the students' learning motivation (Ryan and Deci, 2000). The distinction between sensory and cognitive curiosity was made by Malone (1981). In GSRS, the auditory curiosity is heightened by the music, colours, audio effects, instant feedback, and interactivity as GSRS activates sensory curiosity, while cognitive curiosity is piqued by creating the illusion that learners' knowledge structures are incomplete and inconsistent. A GSRS, Badaboom! was created with the knowledge that these motivating factors would be taken into account when designed a gamified platform.

Sociocultural theory and zone of proximal development theory

Based on Vygotsky's (1978) notion, social contexts and learning are inextricably linked. The key to ensuring that one's strategies are effective in a social context must be able to identify and implement such strategies. Also, it is important to keep in mind that every individual has a unique culture, which is created by their unique strengths, language, and previous experiences. Collaboration with peers or mentors on projects involving real-life tasks and problem-solving skills is one way for students to gain knowledge. Vygotsky (1978) viewed not only social interaction as the most significant component of a child's mental development, but also social experiences as trough which children receive knowledge about the mediational means through which culture transforms basic cognitive traits into higher or more complex ones. Higher mental functions can be exhibited as a result of interaction with peers and mentors. Similarly, Piaget (1970) and Erickson (1977) emphasised that cooperative learning, added to experimentation, aides the process of learning. There is no doubt that peer interaction is crucial in speeding up and facilitating the learning process. The Zone of Proximal Development (ZPD) is a concept proposed by Vygotsky (1978) as a step toward cognitive development. It refers to working on a problem with peers who can offer guidance and encouragement. A challenge must be felt by the learners during the working process. As long as the difficulty level of the challenge is within the learners' Zone of Proximal

Development, then they should feel competent in the process. Since challenges and rapid feedback in digital games are related to progressive stages in Vygotsky's ZPD (Stott and Neustaedter, 2013), it is worthwhile to note that the dynamics of progression found in GSRS can help students enter the ZPD (Chaiklin, 2003). In the next sections, both teaching context and data collection will be explored.

The teaching context

This study was conducted at The Hong Kong Polytechnic University. This was done within the course "English for University Studies," a course that is required of all pre-university freshmen. These students came from diverse faculties such as Applied Science and Textiles, Business, Construction and Environment, Engineering, Health and Social Sciences, Humanities and Design. The course was offered entirely online for 3 h per week over a 13-week period during the COVID-19 pandemic. Besides improving students' English language proficiency within the context of a university study environment, this course aims to help students study effectively in the university's English medium learning environment. When this study was conducted, about 2,000 students were enrolled in 126 sections of this course.

Among the main learning outcomes of the course are (1) the ability to reference sources in written texts and oral presentations, (2) the ability to paraphrase and summarise materials from written and spoken sources; (3) the ability to plan, write and revise expository essays throughout the course using reference to sources; and (4) the ability to present effectively. The course was previously conducted entirely face-to-face, and students were required to write in-class problem-solution assessments using references to the assigned readings and to write an argumentative essay at home, as well as delivering academic presentations. Despite this, at the end of the semester, in a Student Feedback Questionnaire (SFQ) students expressed resentment at having been asked to complete both in-class assessments and homework assignments independently without adequate teacher input during the COVID-19 pandemic. Due to this phenomenon, the instructors of the course initiated a study of innovative methods to enhance the engagement of students through the use of technology, particularly in the case of emergency remote learning.

Methodology

Participants

Between September 2021 and December 2021, the study participants were recruited from full-time students in Year 1 at an EMI university in Hong Kong. An email invitation was sent to all students enrolled in the English for Academic Purposes (EAP) course, and approximately 85 students initially indicated interest in taking part in the study. There were a total of 30 participants who were deemed statistically significant (Kar and Ramalingam, 2013; Alwi, 2015) in the final analysis. It was not considered necessary to have taken similar EAP courses at other tertiary institutions in Hong Kong or their home countries before being shortlisted. Taking into consideration factors such as gender, place of origin and study field, I strive to ensure that the final selection of students is as diverse as possible. 20 Year 1 female students and 10 Year 1 male students from the School of Business, Engineering, Health and Social Sciences, Science, Design and Fashion and Textiles throughout the university were ultimately selected. Participants were guaranteed confidentiality and had the option of withdrawing from the study at any time.

Data collection and analysis

30 semi-structured interviews were conducted with students enrolled in the EAP course that were recorded and transcribed. The interviews ranged in length from 18 to 28 min. To elicit a wealth of information, the participants were interviewed in a non-threatening and comfortable environment in English, and I explored the ways in which they perceived Badaboom! to gain a clearer insight into their experiences and perceptions (Cohen et al., 2018). Audio recordings and transcriptions of the semi-structured interviews were undertaken. Two rounds of member checks confirmed the trustworthiness (Merriam and Tisdell, 2015). Every interview transcript was approved by all participants without changes.

I analysed the data manually using Braun and Clarke's (2006) six-step framework due to the relatively small number of participants. The six-step framework Braun and Clarke (2006) allowed me to analyse the data and create a detailed, rich, and complex account of the results. The six-phase framework includes (1) Familiarisation with the data, (2) Generation of initial codes, (3) Generation of themes, (4) Potential Themes Review, (5) Themes Definition and Naming and (6) Report Production. Some examples of items include: "I can feel the dynamics within the class once Badaboom! was used," "I think performing well in the game is so important."

Incorporating thematic approaches allows researchers to keep their flexibility while conveying their key ideas and perspectives. The second member check was completed by the participants, where they verified that the final results of the project and discussion accurately reflected their own experiences. The following questions were asked during the semi-structured interviews:

(Q1) How would you like to rate Badaboom!?

Thematic map of Badaboom! application in EAP class.
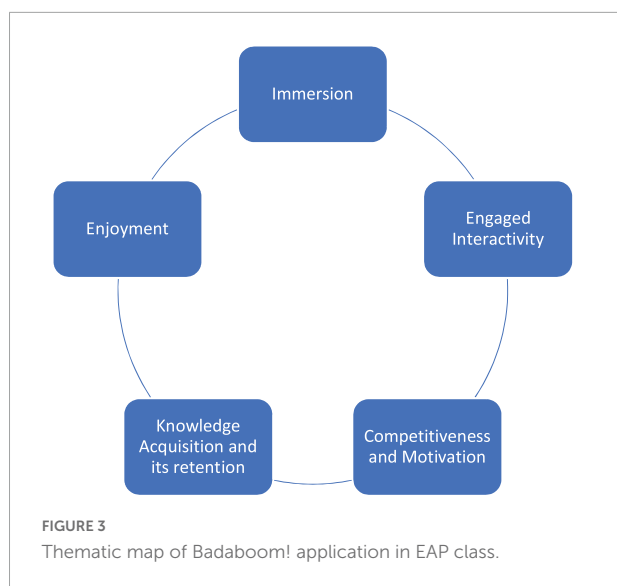
(Q2) When compared with traditional English class, do you think Badaboom! can help you understand more about the content, flow of idea, and style and tone of academic writing at the university level?

(Q3) Did anything make you engage with Badaboom! during the class time?

(Q4) Did anything make you not engage with Badaboom! during the class time?

Using thematic analysis, 30 responses were coded, resulting in five themes. A thematic map with all the responses is shown in **Figure 3**. According to the interview data, the 5 themes provided significant insights into how ESL students approach their learning experience when using Badaboom! during emergency distance learning sessions.

Results and discussion

Throughout this section, the research questions are addressed based on the findings, which examine the student participants' perspectives on Badaboom! regarding its benefits, processes and challenges in the integration of GSRS s into EAP classes. The five themes stated above were listed and organised based on the frequency of categorisation during the thematic analysis process.

Immersion

Based on the findings collected from the semi-structured interviews, almost all of them expressed a preference for Badaboom! integration in their first-year university EAP classes. They agreed that the integration of Badaboom! into EAP course

had advocated the immersion of EAR learning. The concept of immersion is a subjective evaluation of the degree of interaction and the degree of realism of the game (Dede, 2009). A player's sense of engrossment is measured by how much they are absorbed by or engrossed in an experience (Cheng et al., 2015). It is important to point out that game play offers players the opportunity to immerse themselves in a virtual world or a simulation of actual real-world interactions and experiences. Playing a game is an immersive experience consisting of various levels of difficulty or skill level. It is an indicator of the degree of interaction between the player and the game. Participants also said Badaboom! had aided them in recalling and memorising information, while others commented that Badaboom! quizzes, particularly before the submission of assignments, had greatly aided them in staying focussed and refreshed. As shown in these findings, social interaction stimulates cognitive functions in a way that is aligned with what Vygotsky and Cole (1978) believed about how ZPD supports learners' higher-order learning. As Susie reported,

> "I started to love my EAP class. Previously, my English was not good. I just feel that getting a fair pass is enough for me in this course as I am studying engineering. But after teacher used Badaboom! in the class, I feel that English course here is not as dull and boring as in my high school. I am now concentrating in my EAP course."

On top of the concentration, some other students voiced out how the sound effects impacted their concentration. A myriad of student participants appreciated the sound effects built in Badaboom! system which enhances students' learning experience.

> "The background music gives me a beat, boosting me to keep playing and working harder." (Janice)

> "Badaboom! is funny, charming and full of good vibes. I love the way quizzes are presented. You know in the old days, quizzes were presented on white papers and you may feel stressful and nervous when doing quizzes on paper. But now, with the use of Badaboom!, I can do quizzes in a stress-free environment with strong background music." (Mandy)

Another participant voiced out that Badaboom! was particularly useful in which it

> "brings me a vibrant and extraordinary learning experience since I want to immerse myself into achieving higher learning goal." (Jasper)

The above three comments raised by student participants reflect overall impression that through

participating in Badaboom!, participants' immersion can maximise their learning effectiveness. Samson, however, conveyed that he had felt distracted by the time pressure and the music, and he was adversely affected by the audio effects.

> "*When the background music plays faster and faster, I was pushed to answer the questions as quick as possible when the time is up. I am very stressful.*"

Concentration was hampered by the length of the lesson along with the time of day the class was held. There are a number of comments that were made by students who said that Badaboom! relieved feelings of exhaustion and gave them a "refreshing break" from the 2-h session. In an interview with the student, Monica suggested that Badaboom! gave her a chance to "recharge" and "refocus" when she felt tired and sleepy in the morning.

> "*You know it is very difficult to concentrate especially 8:30 a.m. classes on Monday. But after using Badaboom!, this could wake me up to join the class and avoid falling asleep.*"

Engaged interactivity

The results from semi-structured interviews showed that Badaboom! had increased students' opportunities for interacting with peers and assisted them in absorbing the class material to a deeper level. There was general agreement ($N = 30$) from the participants that Badaboom! had promoted active class participation, and made a positive impact on their collaboration skills.

> "*I love team collaboration to answer questions.*" (John)

> "*I didn't like English subject in my high school. But now I have more motive to learn, particularly how to present my idea in an argumentative essay.*" (Sam)

Gamification of classroom experiences, such as Badaboom!, has the potential to enhance an individual's motivational disposition with high-impact experiences that are immersive and flow-oriented. Participants' assertions confirmed previous findings showing that student engagement poses a significant challenge to EAP students (Jarvis, 2020). Therefore, a digital game-based learning experience helps EAP freshmen to foster acquire substantial EAP knowledge. Unsurprisingly, the

participants in the current study described Badaboom! as being vibrant and charming.

Data from the study also revealed an important aspect of participation: anonymity. It has been suggested that allowing students to use nicknames will lead to a wider participation in the study (Nielsen et al., 2013). Anonymity of participation is often seen as a weakness of GSRS (Nielsen et al., 2013). Students said during the interviews that they felt more comfortable using nicknames as they were afraid of answering the wrong way. In addition, students found the quiz activity to be both entertaining and exciting, while two others indicating that they use nicknames only when they are unprepared. These findings confirm those made in Freeman et al. (2006)'s research, which found that maintaining students' anonymity remains essential to fostering student engagement.

> "*Sometimes, I will make a nasty nickname which would make everyone laugh out loud. But it's ok, just have some fun in the class.*" (George)

Interestingly, it was shown that some students expressed great interest in identifying themselves if they got high scores on the leaderboard, as this allowed them to recognise their accomplishments. According to Skadberg and Kimmel (2004)'s research, telepresence (players who feel connected to the action) has been shown to be a key element of a successful game experience.

> "*I feel so proud if my name can come at the top of the list. This is an honour, just like the triumph for online games.*" (Zoe)

Competitiveness and motivation

In the semi-structured interviews, four student participants expressed that Badaboom! had motivated them to learn proactively. This finding seems to suggest that Badaboom! is intrinsically motivating since it brings the users total immersion and optimal gaming experience with an integration of various gaming elements such as goals, rules, timing and rewarding mechanism (i.e., earning points). The following comments describe the degree of competitiveness and motivation brought by Badaboom!.

> "*I can see the value of Badaboom! because I can review how much I've learnt from the previous class.*" (Mark)

> "*I want to get as high grade as possible in my written assessments. That's why I replayed Badaboom! game during*

the spare time even though teacher is not beside me. I can learn how to distinguish between formal and informal words in academic writing." (Rose)

It was revealed that some students would attend English classes knowing that Badaboom! is used. This happened even more often when the English classes commenced at 8:30 a.m. Students said they concentrated more when competing against other students, while others said they studied before class to boost their chances of winning. This is in line with previous results that have demonstrated that GSRS has the ability to significantly enhance competitiveness and boost motivation (Nicolaidou, 2018; Wang and Tahir, 2020). It is also possible to explain this finding using Malone's (1981) intrinsically motivating instructions theory. A key component of sustained motivation, according to Malone (1981), is intense excitement motivated by competitiveness and control. As long as these needs are met, then perhaps interest is fostered in the lesson, leading to a higher level of engagement in the lesson as well as enhanced learning.

Knowledge acquisition and its retention

In terms of learning effectiveness, it was observed that Badaboom! contributed positively to students' knowledge acquisition. Also, it has been reported that Badaboom! helped quite a significant amount of student participants prepare for their written assignments since it is possible for students to measure their learning progress by how well they understand course content.

"Badaboom! works beautifully for me. Besides playing the game in class, I enjoy playing it individually during my spare time based on my schedule. In playing the game, I can keep track of my learning progress, review the key concepts we have learned in class, and reinforce our understanding of academic writing and communication to a broad audience particularly when the written assignment deadline is coming. Playing Badaboom! quizzes in class makes me feel like I'm in a real class. I can also get the explanation from teachers via Badaboom!." (Olivia)

"I can review those questions related to academic writing theory and academic vocabulary, so that I can apply them in my argumentative writing later on." (Sarah)

The above findings are congruent with those presented by Taylor and Reynolds (2018), and Wolff (2016) who

demonstrated that students in EFL contexts might benefit from GSRS to boost their vocabulary banks.

"Badaboom! helped me differentiate what is academic word and what are general words." (Tony)

Additionally, the students emphasised the importance of retaining information and identifying learning hurdles as two outcomes of the learning process. Badaboom! was rated as an excellent tool by numerous students for reinforcing their knowledge, or to identify their problematic area and rectify those errors.

"I can learn from other students if some answers are chosen wrongly." (Phoebe)

"I started to remember the formal academic words when I opted for the wrong choice on the Badaboom!." (Tony)

Badaboom!'s use of visuals, graphics and instant feedback appears to help students gain a deeper understanding of key concepts and characteristics of academic writing. In addition, students found the fact that they received feedback immediately very helpful in staying on top of their progress.

"I found it useful when the teacher discusses with us the wrong answers just after the display of the correct answer on Badaboom!." (Jessica)

Interestingly, when interviewed further about their thoughts on the effectiveness of Badaboom! in EAP courses, though, some of the interviewees expressed reservations including the following:

"This system can bring us lots of fun; however, I do have some doubts that how much we can learn from Badaboom! when compared with other learning tools such as videos." (Tony)

"I know learning should have some fun and I can see the value of Badaboom! in an EAP course, but the problem is Badaboom! still has its own drawback. For example, you can only learn something more if you try to do more follow-up work after class such as library search and consolidation exercises. So I would say persistence is very important. If not, then its educational value is questionable." (Sylvia)

Few students thought that Badaboom! did not help them improve their performance of process writing substantially. This finding is in agreement with Wang and Lieberoth's (2016) finding, who conclude that the use of

gamified platforms did not improve students' learning performance.

Enjoyment

Among all theme categories presented in Figure 3, enjoyment is the most prevalent motivating factor for Year 1 university freshmen students using Badaboom!. Based on the results gathered from semi-structured interviews, it was unanimously agreed that GSRS provides a positive classroom experience due to its element of fun. The Badaboom! quizzes were also perceived as rewarding by students, as they were deemed to be "satisfying." As a result of the Badaboom! experience, students felt that Badaboom! might reduce classroom boredom, making class time more enjoyable and eliminating distractions caused by mobile phones.

> *"Badaboom! gives me a beat when I feel bored in the EAP class."* (Simon)

> *"I love the way Badaboom! presents information. It does not only allow us to respond those open-ended questions, but Badaboom! can also allow images, add emoji, embed YouTube videos in the questions so that students can have more fun."* (Dorothy)

> *"I particularly like the Badaboom!'s virtual quiz lobby. Over there, both nicknames of incoming players and their average confidence level are displayed, so that it can make us more engaged and make the learning experience much more fruitful. It's just like the setup of the mobile phone games."* (Jeff)

In addition to its user-friendliness, students found Badaboom! to be a quick and easy-to-use application. One student even commented on how "quick" the application was. GSRS offered the students a chance to be recognised that might otherwise not have been possible in a traditional classroom setting. It appears that students preferred GSRS over traditional academic instruction. Several students expressed a feeling of joy, excitement and fun gained from playing Badaboom!, which led to a boost in self-confidence when they felt proud of their accomplishments. Interestingly and surprisingly, there were students who even mentioned that they liked sharing the progress they made on social media in order to make their parents and teachers proud of them.

> *"I am so proud of myself when I am always the top of the leaderboard."* (Sylvia)

> *"When I get the top five from the Badaboom! game, I captured the screenshots as to show off in front of my friends on IG. I hope that I can get as many likes in my IG post as possible."* (Marshall)

Conclusion

An examination of undergraduate students' perceptions of an integrated EAP learning environment incorporating Badaboom!, a GSRS, was the purpose of this study. It is suggested here that Badaboom! may be effective at retaining students' attention, increasing their engagement in the learning process, and motivating them to learn. Badaboom! was lauded by the study participants for its fun, engaging, and entertaining features. The competition mode made available by the system was well received by students, which indicates that it contributed significantly to their motivation. It is evident from these results that a GSRS has the potential to assist EAP students of different aptitude levels to succeed academically at English-medium universities. As compared with previous research (Barrio et al., 2016; Wang and Lieberoth, 2016), the results of the study suggest that Badaboom can be a valuable tool for students to enhance their knowledge and vocabulary. However, this does not necessarily entail enhancing students' assessment grades.

Limitation and recommendation

The benefits of Badaboom! are clear for language teachers; however, this study may suffer from limitations that could potentially compromise its validity and generalisability. The primary limitation lies in the nature and functionality of Badaboom!. In an EAP course, students may find it more difficult to practice writing if only GSRS is used. Therefore, teachers should consider involving students in some post-lesson online writing tasks *via* some prominent tools such as Google Docs, OneLook, Bubbl.us, MindMup and Hemingway Editor as a means to help them practice and consolidate academic writing strategies even though many face-to-face lessons are suspended during the COVID-19 pandemic. The second limitation is that Badaboom! is also susceptible to loss of novelty if used excessively (Wang and Tahir, 2020). The final limitation is that the data collected from the semi-structured interviews are completely self-reported by student participants with no assessment records to measure their achievement. Due to this, it is still difficult to conclude that Badaboom! can lead to improved learning performance without further evidence,

since the perception may differ from the real achievement of the learning outcomes.

As far as the recommendation is concerned, it is suggested that strategic integration should be utilised to improve both receptive and productive language abilities. Ideally, Badaboom! integration should occur three to four times per semester. Research in the future may involve tracking students' assessment grades and attendance records in order to corroborate the findings of this study.

Author contributions

The author confirms being the sole contributor of this work and has approved it for publication.

Conflict of interest

The author declares that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note

All claims expressed in this article are solely those of the authors and do not necessarily represent those of their affiliated organizations, or those of the publisher, the editors and the reviewers. Any product that may be evaluated in this article, or claim that may be made by its manufacturer, is not guaranteed or endorsed by the publisher.

References

Alwi, I. (2015). Kriteria empirik dalam menentukan ukuran sampel pada pengujian hipotesis statistika dan analisis butir. *Formatif Jurnal Ilmiah Pendidikan MIPA* 2, 140–148. doi: 10.30998/formatif.v2 i2.95

Azman, M. N. B., Shuraimi, F. B. M., and Yunus, M. B. M. (2018). Enhancing english language learning and teaching via Qgram (Telegram and Quizlet) innovation. *Int. J. Acad. Res. Progr. Educ. Dev.* 7, 435–446. doi: 10.6007/IJARPED/ v7-i4/5344

Barrio, C. M., Organero, M. M., and Soriano, J. S. (2016). Can gamification improve the benefits of student response systems in learning? An experimental study. *IEEE Trans. Emerg. Topics Comput.* 4, 429–438. doi: 10.1109/TETC.2015. 2497459

Braun, V., and Clarke, V. (2006). Using thematic analysis in psychology. *Qual. Res. Psychol.* 3, 77–101. doi: 10.1191/1478088706qp063oa

Caldwell, J. E. (2007). Clickers in the large classroom: Current research and best-practice tips. *CBE Life Sci. Educ.* 6, 9–20. doi: 10.1187/cbe.06-12-0205

Chaiklin, S. (2003). "The zone of proximal development in Vygotsky's analysis of learning and instruction," in *Vygotsky's Educational Theory in Cultural Context*, Vol. 1, eds A. Kozulin, B. Gindis, V. S. Ageyev, and S. M. Miller (Cambridge: Cambridge University Press), 39–64. doi: 10.1017/CBO9780511840975.004

Cheng, M. T., She, H. C., and Annetta, A. L. (2015). Game immersion experience: Its hierarchical structure and impact on game-based science learning. *J. Comput. Assist. Learn.* 31, 232–253. doi: 10.1111/jcal.12066

Cohen, L., Manion, L., and Morrison, K. (2018). *Research Methods in Education*, 8th Edn. London: Routledge. doi: 10.4324/9781315456539

Dede, C. (2009). Immersive interfaces for engagement and learning. *Science* 323, 66–69. doi: 10.1126/science.1167311

Erickson, E. H. (1977). *Toys and Reasons: Stages in the Ritualization of Experience.* New York, NY: Norton.

Freeman, M., Blayney, P., and Ginns, P. (2006). Anonymity and in class learning: The case for electronic response systems. *Austral. J. Educ. Technol.* 22, 568–580. doi: 10.14742/ajet.1286

Gee, J. P. (2005). Learning by design: Good video games as learning machines. *Elearn. Digital Media* 2, 5–16. doi: 10.2304/elea.2005.2.1.5

Jarvis, A. T. (2020). "Fostering engagement in the EAP online landscape," in *Paper Presented at JALT2020 46th Annual International Conference on Language Teaching and Learning, Online, 16-24 November 2020*, Tsukuba.

Kar, S. S., and Ramalingam, A. (2013). Is 30 the magic number? Issues in sample size estimation. *Natl. J. Commun. Med.* 4, 175–179.

Kaya, A., and Balta, N. (2016). Taking advantages of technologies: Using the socrative in english language teaching classes. *Int. J. Soc. Sci. Educ. Stud.* 2:4.

Kohnke, L., and Moorhouse, B. L. (2021). Using Kahoot! to gamify learning in the language classroom. *RELC J.* Online ahead of print. doi: 10.1177/ 00336882211040270

Malone, T. (1981). Toward a theory of intrinsically motivating instruction. *Cogn. Sci.* 5, 333–369. doi: 10.1207/s15516709cog0504_2

Merriam, S. B., and Tisdell, E. J. (2015). *Qualitative Research*, 4th Edn. Newark, NJ: Wiley.

Moorhouse, B. L., and Kohnke, L. (2020). Using mentimeter to elicit student responses in the EAP/ESP classroom. *RELC J.* 51, 198–204. doi: 10.1177/ 0033688219890350

Nicolaidou, L. (2018). "Turn your classroom into a gameshow with a game-based student response system," in *Proceedings 12th European Conference on Game Based Learning, Academic Conferences International Limited, 4-5 October 2018, Sophia Antipolis, France*, (Sophia Antipolis), 487–494.

Nielsen, K. L., Hansen, G., and Stav, J. B. (2013). Teaching with student response systems (SRS): Teacher-centric aspects that can negatively affect students' experience of using SRS. *Res. Learn. Technol.* 21:18989. doi: 10.3402/rlt.v21i0. 18989

Piaget, J. (1970). *Science of Education and the Psychology of the Child.* New York, NY: Orion Press.

Ryan, R. M., and Deci, E. L. (2000). Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. *Am. Psychol.* 55, 68–78. doi: 10.1037/0003-066X.55. 1.68

Skadberg, Y. X., and Kimmel, J. R. (2004). Visitors' flow experience while browsing a web site: Its measurement, contributing factors and consequences. *Comput. Hum. Behav.* 20, 403–422. doi: 10.1016/S0747-5632(03)00050-5

Stott, A., and Neustaedter, C. (2013). *Analysis of Gamification in Education (Technical Report 2013-0422-01). Connections Lab.* Surrey, BC: Simon Fraser University, 1–8.

Taylor, B., and Reynolds, E. (2018). "Building vocabulary skills and classroom engagement with Kahoot," in *26th Korea TESOL International Conference, Seoul, South Korea*, (Seoul), 89–91.

Ting, F. S. T., Lam, W. H., and Shroff, R. H. (2019). Active learning via problem-based collaborative games in a large mathematics university course in Hong Kong. *Educ. Sci.* 9:172. doi: 10.3390/educsci903 0172

Ulla, M. B., Perales, W. F., and Tarrayo, V.N. (2020). Integrating internet-based applications in English language teaching: Teacher practices in a Thai university. *Issues Educ. Res.* 30, 365–378.

Vygotsky, L., and Cole, M. (1978). *Mind in Society: The Development of Higher Psychological Processes.* Cambridge, MA: Harvard University Press. doi: 10.2307/j.ctvjf9vz4

Vygotsky, L. S. (1978). *Mind in Society: The Development of Higher Psychological Processes.* Cambridge, MA: Harvard University Press.

Wang, A. I., and Lieberoth, A. (2016). "The effect of points and audio on concentration, engagement, enjoyment, learning, motivation, and classroom dynamics using Kahoot!," in *Proceedings from the 10th European Conference on Games based Learning, Reading, UK,* (Reading), 738. doi: 10.1016/j.compedu.2020.10 3818

Wang, A. I., and Tahir, R. (2020). The effect of using Kahoot! for learning – A literature review. *Comput. Educ.* 149:103818. doi: 10.1016/j.compedu.2020. 103818

Wolff, G. (2016). Quizlet live: The classroom game now taking the world by storm. *Lang. Teach.* 40, 25–27.

frontiers | Frontiers in Education

Students' perceptions of emergency remote teaching in a writing course during COVID-19

Agata Guskaroska, Emily Dux Speltz, Zoë Zawadzki* and Şebnem Kurt

Department of English, Iowa State University, Ames, IA, United States

The COVID-19 pandemic forced most educational institutions in the US to quickly transfer to emergency remote teaching, finding many instructors and students unprepared. This study explored university students' perspectives in a composition course during the emergency period and proposes guidance on designing a "student-friendly" online learning environment. This study examines the students' concerns about and challenges with emergency remote teaching, the course's benefits during the online learning period, and students' recommendations for improvement. The research was conducted in seven sections of a multimodal composition course at a large, Midwestern university. Participants responded to a virtual discussion board at the beginning of online instruction and a survey after online instruction. Qualitative analysis of responses—guided by the Community of Inquiry (CoI) framework—showed that the participants expressed challenges with staying motivated, completing coursework, and feeling socially disconnected from instructors and classmates. Benefits expressed by the participants included increased flexibility in their schedules, improved time management skills, and increased virtual communication with instructors. This study highlights suggestions that can guide the design of composition courses and pedagogical practices for emergency remote teaching in the future.

KEYWORDS

emergency remote teaching, education during COVID-19, student perspectives, Community of Inquiry (COI), learner-centered online education

Introduction

Writing skills are considered crucial for academic success for college students regardless of their discipline due to the fact that students are evaluated through writing in almost every type of college course (Conley, 2007). Therefore, many colleges and universities offer writing support through mandatory composition courses. These

courses aim to bridge the gap between learners' writing skills acquired in secondary school and the skills required to succeed at the college level and beyond. The writing skills that students gain through these courses are also highly important for employment after graduation (e.g., Kassim and Ali, 2010; Pandey and Pandey, 2014; Weldy et al., 2014). At the authors' institution and many others, these mandatory composition classes have historically been offered in a face-to-face classroom context, with only a few sections, if any, being offered in an online format each semester. Regular in-class peer review workshops (Jensen, 2016), small group activities (Hunzer, 2014), and student-instructor conferences (Patthey-Chavez and Ferris, 1997) are staples of this type of composition class, which made the switch to online classes during the COVID-19 pandemic a dramatic transition. When the COVID-19 pandemic was declared in March of 2020 (World Health Organization, 2020), most educational institutions in the United States were forced to quickly transfer to online courses (Crawford et al., 2020), finding many instructors and students unprepared. Research on online learning before the COVID-19 pandemic that explored students' perceptions did not find any significant difference between students' progress in online and conventional versions of writing courses (e.g., Mehlenbacher et al., 2000), and research has differed with regard to the effectiveness of online learning for college courses in general (*cf.* Phipps and Merisotis, 1999; Johnson et al., 2000). When taking online courses was a choice, not a mandate, online courses were rated lower than face-to-face courses and the students showed a preference for face-to-face courses (Lowenthal et al., 2015). Possible reasons for this included the perception of not having "a real or a human teacher" and the importance of social presence in online courses (Tichavsky et al., 2015, p. 6).

However, with the sudden outbreaks of COVID-19, a shift to online learning became inevitable globally. Online instruction in a regular situation is quite different from online instruction during emergency periods: Whereas regular online instruction is designed to be delivered virtually, online instruction during emergency periods must be developed quickly to provide students with temporary access to course content that would otherwise be presented face-to-face. This study provides an insight into students' experiences with the transition to emergency remote teaching in an introductory writing course. Students' feedback provides valuable data to guide us toward better course designs—particularly those focused on learner-centered education—and improved student engagement in future online courses.

This article will begin with a review of relevant literature. It will then describe the methodology used, present the findings, and provide a discussion and recommendations based on them. Finally, this article draws conclusions about the implications of this study.

Literature review

Learner-centered online education

The National Center for Education Statistics (NCES) defines distance education as "education that uses one or more technologies to deliver instruction to students who are separated from the instructor and to support regular and substantive interaction between the students and the instructor synchronously or asynchronously" (National Center for Education Statistics [NCES], 2020, p. 307). According to the NCES, approximately 34% of all undergraduate students in the United States participated in at least one distance education course in fall 2018, compared to only 8% of undergraduate students in 2000. Additionally, 14% of undergraduates were enrolled exclusively in distance education, which has increased from 2% in 2000 (National Center for Education Statistics [NCES], 2011, 2020). Clearly, online education has grown significantly in the last two decades, especially as US institutions are experiencing increasingly high enrollment numbers and must look for new ways to economically meet the increasing demand for higher education (Tichavsky et al., 2015). As Daymont et al. (2011) pointed out, online education alleviates the strain on the amount of physical space required for classes on campus and provides schedule accommodations for students.

Despite the clear economical and practical benefits of online learning, several past studies discovered that students still reportedly favored face-to-face classes over online (e.g., Diebel and Gow, 2009; Delaney et al., 2010; Tichavsky et al., 2015), with the most prominent reasons being a preference for the teacher's presence in class and challenges with self-regulated learning (Tichavsky et al., 2015). Tichavsky et al. (2015) further sought to investigate this phenomenon by looking into whether students' preferences were based on preconceived perceptions of online learning or their actual experiences with it. They found that one primary pattern that emerged to explain students' aversion to online learning was that students perceived online learning as an independent form of learning and one that lacked interaction with peers and instructors. Kaur and Joordens (2021) provided guidelines to make online learning more effective. In their literature review, the authors discussed the most significant factors that contributed to the success of online learning. Amongst other items, satisfaction and motivation of the students appear in the list of 16 factors.

Relatedly, Ritthipruek (2018) argued that the digital-native students of today's classrooms benefit from elaborate technology-based learning environments to stay engaged and interested in classroom material. However, Ritthipruek (2018) also found that students expressed that they learned best with a blend of different modes of learning, including worksheets, game-based practice, and multimedia. Therefore,

they recommended a blended learning model to increase student performance and maintain learner engagement.

Tichavsky et al.'s (2015) and Ritthipruek's (2018) studies both reflect some of the main ideas of learner-centered education (LCE)—the idea that teaching should focus on the individual needs of learners (Badjadi, 2020). Past research has indicated that implementing LCE methods can be challenging for instructors (e.g., Bai and González, 2019). Despite these challenges in implementation, LCE has been shown to motivate students, develop their communication skills, and stimulate personal growth (Villacís and Camacho, 2017; Ahmed and Dakhiel, 2019; Van Viegen and Russell, 2019). Therefore, it is worth considering how instructors can effectively design their courses to support the ideas of LCE, especially in the context of increasingly common online education.

Emergency remote teaching

Remote learning, online learning, and emergency remote teaching carry different meanings and requirements. The phrase *remote learning* has been used to emphasize the geographically flexible aspect of education whereas with *online learning*, the use of technology is emphasized in the learning process (Moore et al., 2011). *Emergency remote teaching* (ERT), on the other hand, has a temporary nature resulting from an emergency situation (Barbour et al., 2020). While there is a considerable amount of planning and organization behind online and remote teaching (Hodges et al., 2020), in an emergency situation, the same amount of planning and organization might not be achieved. As educational institutions react to crises, they must develop ways to provide students with temporary access to education that would otherwise be presented face-to-face. ERT has been defined as "a temporary shift of instructional delivery to an alternate delivery mode due to crisis circumstances" (Hodges et al., 2020). Whereas traditional online learning is a preference, where the student exercises their right to choose between face-to-face and in-person education, ERT is a forced situation in which choice is taken away from the students and other stakeholders. ERT has already been shown to have negatively impacted several aspects of students' educational experiences during the COVID-19 pandemic. For example, Sarikaya (2021) found low levels of student motivation for writing, which was attributed to a lack of access to the technological tools to support timely feedback. Reduced student concentration (Shim and Lee, 2020) and disengagement due to assignment design (Ismailov and Ono, 2021) have also been reported during the period of ERT due to COVID-19.

During periods of ERT, a shift in focus from the course content to providing support for students during these challenging times might be more helpful (Bozkurt and Sharma, 2020), as that is what the students will remember from the course. Bozkurt and Sharma (2020) note that during periods

of ERT, students often are told to simply watch lectures, but they suggest that it is more important to focus on building a community for the students to have meaningful interactions. One way that many instructors may create these meaningful interactions online is by implementing discussion boards. As Wikle and West (2019) suggest, discussion boards may evoke that sense of community that students seek at this time, but instructors should keep in mind that depending on the topic's difficulty, it may not facilitate learning.

Though it is important to focus on supporting students, faculty needs in this situation must also be considered. Most instructors who went online during the COVID-19 pandemic had no online teaching experience (Johnson et al., 2020; Trust and Whalen, 2020). Hodges et al. (2020) note, "The rapid approach necessary for ERT may diminish the quality of the courses delivered" as substantial planning and preparation is required to develop a quality online course. Therefore, instructors experiencing ERT need support, including resources to improve their classroom practices from home. However, when asked what assistance administrators and faculty needed during the shift to ERT, the most common response was support for students (Johnson et al., 2020). Therefore, it appears that the needs of the students were the number one priority when classes shifted online, reflecting a focus on LCE. Some previous studies have investigated the ways in which instructors have prioritized LCE even when temporarily shifting classes online during the COVID-19 pandemic. For example, researchers have studied student-centered interactions in online English-as-a-second-language classrooms (Bamidele, 2021), graduate veterinary programs (Gonçalves and Capucha, 2020), and lab-based learning in STEM disciplines (West et al., 2021) during COVID-19. Few studies, if any, have proposed guidelines for LCE in online undergraduate composition courses or investigated students' perceptions of such courses during emergency periods. The present study aims to fill this gap. Schools, teachers, and even the educational technology (EdTech) industry are learning from this shift to ERT (Williamson et al., 2020), and the adjustments made will have long-term implications for the future of education.

Community of inquiry framework

To effectively assess course design concerning LCE and ERT, it is necessary to consider a framework that can be used as a guide for evaluation. The Community of Inquiry (CoI) is one such framework that has been used as a "guide to educators for the optimal use of computer conferencing as a medium to facilitate an educational transaction" (Garrison et al., 1999, p. 87). CoI has been defined as an educational framework in which learners experience social, teaching, and cognitive presence through scientific inquiry. Garrison (2009) describes social presence as participants' sense of belonging to

the community they are in and their communication with this community in meaningful and deliberate ways. Social presence should also include open communication, group cohesion, and affective expression. Teaching presence involves designing and implementing the course, facilitating discourse among students, and directly instructing students. Finally, according to Garrison (2007), cognitive presence is related to learners' understanding of the course and what is required, and it is achieved through events that trigger learning, exploration of ideas, integration and connection of ideas, and the application of new ideas.

The use of CoI in a learning environment signifies a purposeful and supportive collaboration between the teacher and the students, and thereby knowledge is constructed in a trusted environment (Garrison, 2006). Past research confirms this, with results indicating that students who feel a sense of belonging and are content with the course are more successful (Akyol and Garrison, 2008; Morris, 2010). The sense of belonging in online courses seems to be achieved through discussion boards as a way to communicate and interact with other learners in the course and the teacher (Morris, 2010). According to Morris (2010), this kind of interaction increased the involvement of the individual learners in the course, which in turn increased their success.

Many researchers have used the CoI framework, and so far, it has been shown that it is a useful theoretical framework and a suitable tool to investigate and design online learning experiences (Akyol and Garrison, 2008). Nonetheless, online learning experiences might differ from online learning in emergency situations, such as the lockdown during the COVID-19 pandemic. How students perceive social, teaching, and cognitive presence through scientific inquiry during these extenuating circumstances in a university level writing course is yet to be explored. Therefore, the purpose of this study is to investigate the students' concerns about and challenges with emergency remote teaching, the course's benefits during the online learning period, and students' recommendations for improvement through the lens of the CoI framework to provide suggestions and insights for the design of future courses.

Aim of the study

This study explores students' perceptions of a composition course during the emergency remote period and proposes guidance on designing a learner-centered online education environment. This study examines the students' concerns, challenges, perceived benefits, and recommendations for improvement.

While coping with a global crisis, this quick transition to online learning found many students unprepared and unfamiliar with online learning. Thus, the researchers strongly believe that exploring students' perceptions is of the utmost importance and will provide support in similar emergency

situations in the future. This study may also contribute to understanding features of learning environments that influence engagement—including physical, social, and technological contexts—and serve as general guidance for the design of online composition courses.

The present study was guided by the following research questions:

> RQ1: What are the students' concerns and challenges with online learning in a writing course during COVID-19?

> RQ2: What are the benefits of online learning in a writing course during COVID-19?

> RQ3: What are the students' preferences and recommendations for improvement?

Methodology

Context and participants

Participants were undergraduate students enrolled in an introductory, multimodal composition course at a large, Midwestern university in the U.S. This course is mandatory for most undergraduate students at the university and is considered sophomore-level (year two). Students from seven sections of this course were selected to participate in the present study *via* convenience sampling, as the researchers were teaching these sections at the time of the shift to ERT. The curriculum and class schedule of all sections were guided by Canvas modules created by the course coordinators, meaning that all seven sections were almost identical in course structure and design, with only minor differences when instructors chose to modify small assignments. Each section had approximately the same number of students (n = 20–24). This course served as an interesting example of a class that originally met in person but had to quickly transition to emergency remote teaching utilizing asynchronous communication after the ninth week of the Spring 2020 semester.

While most participants were native English speakers, a few were international students with first languages including Spanish, French, Italian, Chinese, and Swahili. Participants' gender and age information was collected to be reported in aggregate following an established convention in linguistics research. A discussion board post was completed by 104 students during the first week of online instruction, and a Qualtrics survey was completed during the semester's final week. The discussion board prompt can be seen in Figure 1. Although biodata were not available for participants who only completed the discussion board post, the average age of the 29 (16 male, 13 female) participants who completed the Qualtrics

FIGURE 1
The discussion board prompt.

survey was 20 years old, and these data are believed to be representative of the larger group of participants as well due to the course's nature as a mandatory sophomore-level class. Of the 29 students who completed the Qualtrics survey, 34% ($n = 10$) responded that they had taken an online course before, and 55% ($n = 16$) responded that they had not (three participants did not answer this question). Discussion board posts were anonymized prior to data analysis. The Qualtrics data were collected anonymously. This study was reviewed and considered exempt by the university's institutional review board.

Data collection

This study used a qualitative method for data collection and analysis. Two forms of data collection were designed to achieve this study's goals.

First, participants responded to an online discussion board at the beginning of the online instruction period. This discussion board was designed to gauge student concerns and provide an opportunity for instructors to answer students' questions about online coursework at the beginning of the emergency remote teaching period. Two prompts were included in these discussion board posts: (1) What questions or concerns do you have about online learning? and (2) What do you anticipate will be your biggest challenge for completing the coursework? It should be noted that this method of data collection was utilized in six of the seven sections; one instructor chose to omit this from their class curriculum.

Second, participants from all seven sections responded to a Qualtrics survey consisting of questions designed in an anonymous survey format to elicit honest responses about areas in which the course and instructors could improve. The Qualtrics survey was prepared by the authors and validated through a feedback loop among the authors and peer reviewers (graduate students in applied linguistics). The survey was sent to participants through an announcement on the course's learning management system. This announcement explained the general purpose of the study and informed

participants that participation was voluntary and answers would be anonymous. The survey was split into three sections for participants' convenience. The first five questions comprised the first section and were created to gather the participants' biodata, first languages, instructor, and experience with online coursework. The second section consisted of five open-ended questions designed to elicit answers to the research questions. The final section consisted of 10 Likert-scale questions to elicit participants' attitudes about the emergency remote teaching period. The participants were given the choice to select from five options (strongly agree, somewhat agree, neither agree nor disagree, somewhat disagree, and strongly disagree), as well as to explain their answers after their Likert-scale responses. The full Qualtrics survey can be found in **Supplementary Appendix A**.

Data analysis

Informed by the CoI model (Garrison et al., 1999), responses to open-ended questions in the discussion board and Qualtrics responses were manually coded by the four researchers using an open and axial coding process (Berg, 2004). During an initial round of open coding, all four researchers independently coded a small sample (20%) using the CoI model to establish a general understanding of the existing CoI themes and to check for inter-coder reliability. After the open coding process, the researchers met remotely and discussed the disagreements in coding until an agreement was reached. The researchers then completed axial coding to develop a coding guide consisting of themes, sub-themes, and examples. Certain examples did not fit in any of the existing categories on the CoI, so a fourth category was developed for technological responses labeled "Other." After the categories and expectations were clear, to ensure the reliability of the researchers' manual coding, all open-ended Qualtrics questions were coded independently by two of the researchers. Inter-annotator reliability was assessed using Krippendorff's alpha (Krippendorff, 2007), yielding $\alpha = 0.858$ (high reliability). For the discussion board responses, a random sample of 20% of

the open-ended responses was annotated by a second researcher, yielding α = 0.865 (high reliability). Likert-scale results were analyzed utilizing simple descriptive statistics.

Findings

This section presents the findings pertaining to the three research questions. The first research question addressed the concerns students had and the challenges students faced regarding the transition to ERT. The second question addressed students' perceived benefits after completing the ERT period. The final question addressed students' preferences and recommendations for future writing classes during periods of ERT. Themes in student responses are sorted into the three main elements of the CoI framework (cognitive, social, and teaching) as identified through the data analysis process described above. Likert-scale responses from the Qualtrics survey are discussed alongside relevant thematic findings, and a summary of these responses can be found in **Supplementary Appendix B**.

RQ1: Concerns and challenges

Table 1 presents an overview of the concerns identified by students in the discussion board posts prior to ERT and the challenges identified by students in the Qualtrics survey after the ERT period.

As shown in **Table 1**, the discussion board themes emerging at the beginning of online instruction included being worried about understanding assignments, staying on top of assignments, and learning online instead of in the traditional classroom. One student expressed their cognitive concern when they said, "My biggest concern would be misunderstanding the directions of an assignment. I don't want to do an assignment completely wrong because of a misunderstanding and then get points off for that reason only." Another student stated their cognitive concern when

they posted, "I have concerns about actually learning online, rather than from a [sic] in-person classroom." Other students shared this sentiment about learning differently online than in person. This expresses a similar theme among many students' posts.

When asked about cognitive challenges, an overwhelming amount of responses indicated that deadlines and keeping track of assignments would be challenging in the online environment, especially regarding time management. One student expressed these cognitive challenges when they said the following:

> "I'm concerned for the time management involved with online classes (i.e., the new assignments we have instead of doing them in class, trying to balance the various formats of all my classes, and making sure I pace myself correctly, etc.) and how that will impact writing essays."

Another challenge seen repeatedly in the responses was the idea of staying motivated as the classes moved online and students moved from the campus environment to home. This can be seen in one student's response: "I've got plenty of time, but finding the motivation when I'm stuck in here might be a problem." These challenges were also indicated at the end of the course.

After the move online and completing the course, the students stressed the absence of motivation and problems with technology. Before the transition, students were worried about misunderstanding the assignments. The Qualtrics survey revealed that some of the students did experience confusion about expectations of them with the transition online. An overall cognitive concern in the Qualtrics survey included stress about the transition: 48% of the students agreed with the statement, "I was stressed about the transition to online coursework." When the transition to online first started, the students were worried about time management and deadlines. When given the statement "I spent more time learning and working for this class online compared to in-person," 40% of the students agreed with it.

TABLE 1 Concerns and challenges identified by students prior to and during the emergency remote teaching (ERT) period.

	Cognitive	Social	Teaching
Concerns prior to the ERT period	Fear of misunderstanding assignments	Inability to communicate with peers about assignment expectations	Inability to immediately ask questions/clarify expectations
	Learning how to manage time and deadlines independently	Receiving writing feedback from peers	Fear of missed/delayed communication
	Learning outside of a traditional classroom	Eliminating discussions about class topics	Lack of face-to-face office hours
Challenges identified after the ERT period	Staying motivated	Collaborating with peers	Lack of face-to-face writing feedback
	Troubleshooting technological issues	Interacting face-to-face with the instructor	Lack of face-to-face office hours
	Managing stress		Inability to ask questions in person

At the beginning of online instruction, students were also concerned with the lack of a social aspect in an online class. This includes group work and communicating with their peers to better understand assignments and receive writing feedback. One student mentioned the following:

> "I am concerned about getting help/asking questions about my work. What I liked about this class was the ability to ask questions and get help from peers in person. So I am concerned about the switch to online and how I will ask questions."

Students were unsure how to communicate with their peers and have the same interactions as they did in class. This student exemplified this notion when saying the following:

> "I think it will definitely be difficult to communicate with others in the class and have discussions about our topics as well as getting in-person feedback. Unfortunately, responses won't be as in-depth."

Students enjoyed group work and found it helpful, making them concerned that they might lack that aspect in the transition online. One student stated, "The peer/group work aspect of the class has always been helpful, so I am worried about how things will go when that isn't an option."

In the Qualtrics survey distributed after instruction ended, lack of social presence was mentioned by the students. When asked what was challenging about the course, one student mentioned a challenge was "Not having other student [*sic*] to collaborate with easily." Along with interaction with fellow students, a few participants also discussed the lack of in-person interaction with the professors. In the challenges prompt, there were answers such as "Not having the opportunity to meet with professors in person" and "Not having a physical person to ask for help or being able to go to an 'office hour.'" These concerns tie into some of the teaching concerns that the students had regarding communication.

At the beginning of online instruction, an overwhelming concern was the clarity of the assignments and being able to understand what the instructor was looking for. Students were also concerned about the deadlines and large amounts of tasks. These two concerns were combined into one comment on the help forum when a student stated:

> "I think my biggest challenge will be understanding the work and the expectations for our assignments. I am also worried about meeting all the deadlines and completing my work in time."

Another student expressed concern about clarity when they wrote: "I am concerned about getting help with essays. Usually, we have examples in class and can ask questions then and there to clarify." In other words, prior to receiving online instruction, this student was concerned that they would not be able to immediately ask questions to an instructor if they wanted to clarify something in the course content due to the course's asynchronous structure. Similarly, some students were worried about communication with the teacher. This involved being unable to ask questions in class and being concerned about general communication with the instructor. One student mentioned:

> "My biggest concern would be the communication aspect. I know [the teacher] is very diligent when answering emails to students, but sometimes an email can be skipped over by accident."

These concerns carried on throughout their time in the online course and were also reported in the Qualtrics survey.

After instruction, students also indicated some challenges related to the teaching aspect of the course. These were mostly the same concerns as before instruction. Students mentioned "Not having the opportunity to meet with professors in person," "Not being able to ask questions in person," and "No [in-]person feedback on writing" as some challenges they faced. When given the statement "I was frustrated with the way my English 250 instructor handled the switch to online coursework," 32% of the students agreed. Though there were many challenges and concerns from the students, there were also some benefits to online learning.

RQ2: Benefits

Table 2 presents an overview of students' perceived cognitive, social, and teaching benefits of the ERT period.

Some students brought up the flexibility and possibility of rewatching videos as an important benefit of online learning. One student stated, "I liked the flexible schedule and freedom. I could rewatch videos if I missed something." This flexibility is relevant for the students because rewatching videos shows

TABLE 2 Students' perceived benefits of the emergency remote teaching (ERT) period.

Cognitive	Social	Teaching
Flexibility in managing time and completing assignments	Fewer social distractions inhibiting coursework	Clear instructions and expectations
Ability to rewatch lecture videos	Flexibility with personal schedules	Weekly announcements with reminders
Improving time management skills		Availability for virtual communication
Acquiring new computer skills		Frequent feedback on low-stakes assignments
Reprioritization of course workload		

how they are trying to resolve ambiguities in understanding. While in-person or synchronous teaching does not allow the student to listen to the lecture again, students pointed out that with the recorded videos, they had the opportunity to clarify missing information. Along the same lines, a few students stated that the quick transition to online learning forced them to be self-organized to keep up with coursework; as one student commented, "[My] time-management skills definitely are stronger." The students did not have frequent in-person reminders from the instructors or communication with their classmates, so they needed to be responsible for their own time management and self-paced learning. A few of them pointed out that this has increased their ability to organize their time.

Other benefits included acquiring new computer skills: as one student stated, "It helped me learn many different things that are in computer [sic] such as studio recording." It is important to note that 92% of the students stated they felt well equipped with the technology and internet access that facilitated their work. Many of the oral presentations had to be performed virtually, and due to the asynchronous nature of the course, the students had to learn screen recording tools to create their project presentations. A few students found this beneficial for the development of their cognitive skills. Finally, students discussed that removing some unnecessary work "helped with lack of motivation." Therefore, perhaps keeping a minimal number of smaller assignments would provide less cognitive effort on behalf of the students, allowing them to focus on the major assignments.

Most participants (80%) expressed that their instructors helped them succeed in the transition to online coursework and that they felt well-prepared to complete the final writing assignment with the materials provided to them online. Interestingly, 32% reported frustration with how the course was handled, but their answers also indicated that instructional management was crucial for their success. Having clear and easy-to-follow expectations on a weekly basis was one of the things students appreciated the most. As one student stated, "[The instructor] made the transition very easy by clearly telling us her expectations week after week and made sure we knew when things were due." The instructors sent out weekly announcements summarizing the main points and deadlines for the following week. According to the students' comments, this was one of the biggest strengths and benefits of these online courses.

Another important benefit that emerged from the data was having a supportive instructor who is available for virtual communication and who provides feedback on the smaller assignments. It is no surprise that increased communication allows support and guidance for the students. For example, one student stated, "My teacher was fantastic with communication and answering questions." Hence, students found the teacher's (virtual) presence an important factor for success. Additionally, as some students stated, getting feedback from the instructor,

whether spoken or written, is one of the most relevant ways to keep the students on the right track in remote learning. Interestingly, some students enjoyed the asynchronous teaching flexibility and independence. It appeared that the students enjoyed the schedule flexibility but also needed direct support from the instructor, either *via* quick email responses, virtual availability, or feedback to guide their work.

Even though social benefits were more difficult to observe during emergency situations like this, the students brought up a few advantages of this experience. For example, one student stated they were "less distracted from social life" which allowed them more time to focus on studying. Having almost no opportunities to socialize due to the lockdown in March and April amid COVID-19 may have forced some of them to stay at home and use their time to study. On another note, a few other students suggested having more time for themselves as another benefit of online learning. One student commented that they had been able to sleep in, and another stated that they were able to enjoy "mindless self-indulgence." Many courses transferred to an asynchronous format which likely allowed the students to have more flexible schedules.

RQ3: Preferences and recommendations

Table 3 presents a summary of students' preferences and recommendations for future ERT situations upon the completion of the course.

Interestingly, all of the responses regarding preferences and recommendations that referred to students' cognitive capabilities expressed that the online portion of the course was reasonable and effective. For example, one student expressed the following: "Honestly, despite the technical difficulties, online learning is really effective for me, and I wouldn't change anything." This response demonstrates that the student successfully integrated their online learning experience with their cognitive abilities.

Similarly, another student who expressed no desire for changes to the online course structure explained that the

TABLE 3 Students' preferences and recommendations for emergency remote teaching (ERT).

Cognitive	Social	Teaching
Continue to allow flexibility in managing coursework	Incorporate synchronous online class sessions/interactive discussions	Eliminate or reduce low-point assignments
Continue to provide accessible course content	Incorporate social interaction between the instructor and students	Provide frequent opportunities for feedback from the instructor and peers

online course allowed them greater flexibility in the ways they completed coursework: "[Online coursework] allowed me to listen to videos more than once and pause videos, as well as be able to do work whenever it fits into my schedule." As in the previous example, this student successfully connected ideas and created solutions, an indicator of the sub-category "integration" in their cognitive presence.

One of the main social recommendations was to incorporate synchronous video sessions to allow for more personal interactions between the instructor and the students. Some students expressed feeling a lack of communication with the purely asynchronous online format, so this recommendation stemmed from their desire to incorporate a more social form of communication into the course. One student specifically recommended "having online meetings for occasional class discussions," indicating that they desired a class-wide, interactive discussion rather than simply watching the instructor in asynchronous video format.

Other students felt that their social needs were well addressed by how their professors communicated with them during the period of emergency remote teaching. For example, one student stated the following:

> "My professor's availability online was outstanding, Bravo Zulu.[1] Any concerns I had were met with understanding and worked through to help me keep going. Without the ability to communicate with my professor I may have completely withdrawn from attendance."

In this case, this student's preference for online instruction included frequent online meetings and emails which catered to their social needs. In their view, the social interaction with the instructor kept them from withdrawing from the course.

Finally, some students expressed a desire for additional peer-review sessions with their classmates. Whereas each instructor set up peer-review sessions differently when classes were in-person, they all used a built-in peer-review tool in Canvas during the period of emergency remote teaching. Unlike in-class peer-review sessions, this tool did not allow for much social interaction between the reviewer and the reviewee. The reviewer merely left comments on the reviewee's draft, and there was not an opportunity for students to discuss recommendations or changes to be made as they did in person. Therefore, the call for more peer-review sessions likely stemmed from students' desires to collaborate with each other as they had been doing throughout the semester in person.

In addition to the social aspect, the majority of students' recommendations for teaching involved ideas about the course's instructional management. Providing an opportunity for weekly

---

1 "Bravo Zulu" is a phrase traditionally used by members of the United States Navy to mean "Well done!" (Naval History and Heritage Command., 2017).

synchronous video sessions was discussed above as a social recommendation, but it also falls into the category of teaching and instructional management since teachers must coordinate these synchronous sessions and integrate them into the instruction of the course. In fact, 44% of the students in the Qualtrics survey expressed that they would learn better if the class had real-time lectures instead of recorded videos. One student phrased this recommendation as follows: "Offer an online 'in-class' option, i.e., a Zoom call or similar software that can be used to simulate a real classroom that is optional or is recorded for students to watch." In this response, the student expressed a desire for a "real classroom" experience that could be made possible with a synchronous video session, but they also recommended recording these sessions and making them optional. Recording video sessions for students to watch later (i.e., asynchronously) is one way to continue the benefits of asynchronous teaching (expressed in RQ2 above) while also ensuring that all coursework is accessible for students: Those who do not have a reliable internet connection at home or those who must take on additional responsibilities due to the pandemic may not be able to attend the synchronous session, but a recording allows them to view what they missed during that time.

When this course moved online for ERT, the instructors had to quickly reimagine the in-class activities that they had planned. Many of these activities were restructured as low-point assignments or discussion board posts on Canvas. A few student recommendations referred to these low-point assignments as "busy work," and many responses called for a reduced number of these assignments. For example, one student called for "less mandatory discussion questions/drafts, [and] fewer assignments but more demanding ones." For this student, the online discussion forums were not necessarily cognitively demanding, but they may have overwhelmed them simply by the increased number of assignments on their to-do list. Therefore, the recommendation that emerged from these responses was to reduce the number of low-point assignments that replaced in-class activities while putting more emphasis on high-point major assignments.

Discussion and recommendations

This section presents a discussion of the findings along with suggestions offered that can be used to guide the design of composition courses and pedagogical practices during situations of emergency. College composition courses are historically significant at US universities as the most-required course in higher education (Crowley and Hawhee, 1999). Although Crank (2012) asserts that it is a challenge to help freshmen with improving their writing skills, over the course of students' college life, their writing skills are believed to be improved through the writing courses that they take

(Oppenheimer et al., 2017). However, it is important to note that writing proficiency has been found to be context-bound and dependent on general writing skills (Oppenheimer et al., 2017). In this study, the recommendations provided will be context-specific, focusing on the emergency remote teaching situation so that future courses are better informed about what measures to take when designing a writing course during another emergency situation.

The present study examined students in a required university composition class who were forced to quickly move online for a period of ERT. The students in this study listed misunderstanding of the instructions, difficulty keeping track of deadlines, a lack of motivation, and technological challenges as the leading cognitive concerns. Online learning entails more autonomy on the part of the student since there is no physical space to attend to and no instructor to report to face-to-face. Therefore, it is up to the student to take charge of their learning, follow the syllabus, and find ways to solve learning problems resulting from the lack of traditional, face-to-face education. Similar to the students in this study, the students in Borkotoky and Borah's (2021) study suffered from similar cognitive challenges, where they experienced a lack of motivation and concentration and fatigue from the online classes during the ERT period. The students also reported difficulties accessing the internet to complete their assignments. One cognitive challenge the students did not report experiencing in this study is boredom from online learning, which was expressed by the students in Almansour and Al-Ahdal's (2020) study. The findings revealed that this boredom resulted from a lack of classroom interaction, which is typical of in-person learning. Several other studies also reported student boredom during ERT (e.g., Irawan et al., 2020; Derakhshan et al., 2021). This cognitive challenge might stem from a long-standing tradition of in-person education the students were familiar with prior to the ERT period. However, it might also be related to the other factors that need further exploration. Consequently, the fact that the students in this study did not raise boredom as a concern or a challenge for their online writing course is an important finding that emerged implicitly from the research.

Some additional aspects of the COVID-19 ERT period align with previous findings from online learning research. Students in this course reported being concerned about the social aspect of the in-person course and discussed that they needed a "physical person" to talk to, similar to Tichavsky et al. (2015). They also expressed the need for synchronous video sessions, indicating the need for teaching presence to facilitate cognitive presence, or as Garrison et al. (2010) suggest, "to encourage active discourse and knowledge construction" (p. 93). Moreover, one particularly important type of skill acquisition that occurred during the emergency remote teaching period was related to technological literacy. Bourelle et al. (2017) assert that to promote multimodal literacy, online writing classes should teach technology and incorporate multimodal assignments and appropriate scaffolding tools. In this study, 92% of students

expressed that they felt well equipped to succeed in the course with the technology they had access to at the beginning of the online period, yet several students expressed that a major benefit of the online period was being able to hone their computer skills even more (e.g., learning how to use Canvas studio recording tools for asynchronous presentations).

On the other hand, certain aspects were unique to the emergency period. Students who signed up for an in-person class were forced to quickly transition to an online learning course. According to Garrison et al. (2010), "high levels of social presence with accompanying high degrees of commitment and participation are necessary for the development of higher-order thinking skills and collaborative work" (p. 94). Thus, it is important to note that for the students in this study, the degree of commitment might have differed from that of a regular, online environment where the students chose to receive online education. The lockdown, the fear of virus transmission, and financial insecurity might have caused stress and discomfort for some students. On the other hand, bearing in mind that students' lives tend to be busy with studying and socializing, it appeared that some students enjoyed their "time off" when they could stay and work from the comfort of their homes. In terms of course design, to facilitate the cognitive load, the weekly announcements and clearly stated deadlines were considered a major strength of the course showing the need for a structured, simple, and easy-to-follow approach. Finally, by the end of the semester, a majority of the participants expressed that their instructors helped them succeed with online coursework. This demonstrates the relationship between students' cognitive concerns and teachers' roles in alleviating undue stress.

Amid all the challenges and unexpected benefits of this emergency remote teaching period, recommendations that may be informative for creating a positive, learner-centered online teaching environment were developed. These recommendations are based on the findings of this study, and they address the overlapping components of the CoI framework by prioritizing *setting climate*, *supporting discourse*, and *selecting content* to improve students' experiences with ERT (Garrison et al., 1999). Below these recommendations for facilitating a learner-centered approach to teaching during emergency periods are summarized.

1. The first recommendation is that instructors **incorporate optional synchronous video sessions** to allow for a more personal interaction (assisting with students' social needs) between the instructor and the students, along with uploading a recording of these sessions to the class's learning management system to ensure accessibility for the entire class.

2. The next recommendation is to **increase communication channels** with students, including frequently **communicating structured, clear, and easy-to-follow expectations**. Whereas some students will get by with a weekly email update of class requirements, it was

found that others will rely on open video conferencing hours (for instance, on Zoom, Microsoft Teams, or other video conferencing systems) where they can both express themselves and work through their struggles with their instructor.

3. Furthermore, instructors are encouraged to **provide opportunities for student collaboration.** During periods of ERT, some students may live alone with very little social interaction. Class activities—such as collaborative peer review sessions, synchronous work time on Google Docs, or websites such as Perusall (Kohnke and Har, 2022)—can serve as an opportunity to facilitate students' social needs while also improving their learning experience. This recommendation also addresses students' expressed concern about receiving less writing feedback from their peers and instructor during the ERT period.

4. The final recommendation is for teachers to **reduce unnecessary tasks** for students whenever possible. While it may seem like a good idea to provide a variety of low-stakes assignments and activities for students to complete in lieu of in-person class time, these extra assignments may be an overwhelming burden for students who are still figuring out how to manage their lives during an emergency situation. Focus on designing major assignments around the most important learning outcomes of the course instead, and encourage students' development of time management skills by sticking to a reliable schedule for posting this important course content.

These recommendations come together to address all aspects of the CoI framework by acknowledging social, cognitive, and teaching components of managing a virtual classroom environment. It is believed that these recommendations will improve students' and teachers' educational experiences with online writing courses during emergency periods.

Conclusion

"Writing may be by far the single academic skill most closely associated with college success" (Conley, 2007, p. 5) due to its cross-disciplinary importance in college courses. Therefore, it is of utmost importance to maintain the quality of writing courses even during unprecedented times to support the college students not only during their time in college but also after graduation when they are looking for employment. The aim of the present study was to explore students' perceptions in a university writing course during an emergency period and propose guidance on designing a learner-centered online education environment for emergency situations. This study investigated students' perceptions of ERT during the period of lockdown due to COVID-19 in 2020. Students shared their concerns, challenges, and perceived benefits and preferences regarding ERT in this

university writing course. The CoI framework provided an overview of all these components through cognitive, social, and teaching presence lenses.

A few limitations were present in this study. First, the scope of this study was limited due to the unexpected nature of the emergency remote teaching period. Only four instructors (seven sections) in one university department were included in this study, limiting the generalizability of these results. Future studies should draw from a larger pool of students and classes to produce more generalizable results. Additionally, because this study relied on discussion board posts and survey responses, students' responses were brief and may not reflect the full depth of their perspectives. Future research should engage students in semi-structured interviews to capture their perceptions of ERT more fully and contribute to the design of learner-centered online classrooms.

Despite its limitations, this study presented a way to explore students' perceptions of ERT through the lenses of the CoI framework. Results showed that while students encountered challenges, such as lack of motivation and feeling a social disconnect, they also found a few benefits, such as increased schedule flexibility, and improved time-management skills. This study presented recommendations that can be used as a guide for facilitating online teaching, especially in university writing courses, during emergency periods.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

The studies involving human participants were reviewed and approved by the Institutional Review Board (IRB), Iowa State University. The ethics committee waived the requirement of written informed consent for participation.

Author contributions

AG led the conception of this study. All authors contributed equally to designing the study, coding portions of the data, writing the first draft of the manuscript, contributed to manuscript revision, and read and approved the submitted version.

Funding

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note

All claims expressed in this article are solely those of the authors and do not necessarily represent those of their affiliated organizations, or those of the publisher, the editors and the reviewers. Any product that may be evaluated in this article, or claim that may be made by its manufacturer, is not guaranteed or endorsed by the publisher.

Supplementary material

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/feduc.2022.965659/full#supplementary-material

References

Ahmed, S. A., and Dakhiel, M. A. (2019). Effectiveness of learner-centered teaching in modifying attitude towards EFL and developing academic self-motivation among the 12th grade students. *Engl. Lang. Teach.* 12, 139–148. doi: 10.5539/elt.v12n4p139

Akyol, Z., and Garrison, D. R. (2008). The development of a community of inquiry over time in an online course: Understanding the progression and integration of social, cognitive and teaching presence. *J. Asynchr. Learn. Netw.* 12, 3–22. doi: 10.24059/olj.v12i3.66

Almansour, M. I., and Al-Ahdal, A. A. M. H. (2020). University education in KSA in COVID times: Status, challenges and prospects. *Int. J. Innov. Creat. Change* 14, 971–984.

Badjadi, N. E. I. (2020). Learner-Centered English Language Teaching: Premises, Practices, and Prospects. *IAFOR J. Educ.* 8, 7–27. doi: 10.22492/ije.8.1.01

Bai, X., and González, O. R. G. (2019). A comparative study of teachers' and students' beliefs towards teacher-centered and learner-centered approaches in grade 12 English as a foreign language class at one governmental senior secondary school in Shaan'xi Province, China. *Scholar* 11, 37–44.

Barbour, M. K., LaBonte, R., Hodges, C. B., Moore, S., Lockee, B. B., Trust, T., et al. (2020). *Understanding pandemic pedagogy: Differences between emergency remote, remote, and online teaching. State of the Nation: K-12 e-Learning in Canada.* Halfmoon Bay, BC: Canadian eLearning Network.

Bamidele, A. (2021). "Student-Centered Interactions within an ESL Classroom using Online Breakout Room," in *Proceedings of the AUBH E-Learning Conference 2021: Innovative Learning & Teaching - Lessons from COVID-19*, (Pearson). doi: 10.2139/ssrn.3878774

Berg, B. L. (2004). *Qualitative research methods for the social sciences*. Netherland: Pearson.

Borkotoky, D. K., and Borah, G. (2021). The impact of online education on the university students of Assam in COVID times. *Indian J. Sci. Technol.* 14, 1028–1035.

Bourelle, T., Clark-Oates, A., and Bourelle, A. (2017). Designing online writing classes to promote multimodal literacies: five practices for course design. *Commun. Design Q.* 5, 80–88. doi: 10.1145/3090152.3090159

Bozkurt, A., and Sharma, R. C. (2020). Emergency remote teaching in a time of global crisis due to CoronaVirus pandemic. *Asian J. Dist. Educ.* 15, 1,i–vi.

Conley, D. T. (2007). *Redefining college readiness.* New York: Educational Policy Improvement Center.

Crank, V. (2012). From high school to college: Developing writing skills in the disciplines. *WAC J.* 23, 49–63.

Crawford, J., Butler-Henderson, K., Rudolph, J., and Glowatz, M. (2020). COVID-19: 20 countries' higher education intra-period digital pedagogy responses. *J. Appl. Teach. Learn.* 3:1. doi: 10.37074/jalt.2020.3.1.7

Crowley, S., and Hawhee, D. (1999). *Ancient rhetorics for contemporary students.* Boston, MA: Allyn and Bacon, 2–19.

Daymont, T., Blau, G., and Campbell, D. (2011). Deciding between traditional and online formats: Exploring the role of learning advantages, flexibility, and compensatory adaptation. *J. Behav. Appl. Manag.* 12, 156–175.

Delaney, J., Johnson, A. N., Johnson, T. D., and Treslan, D. L. (2010). "Students' perceptions of effective teaching in higher education," in *26th Annual Conference on Distance Teaching and Learning*, (University of Wisconsin).

Derakhshan, A., Kruk, M., Mehdizadeh, M., and Pawlak, M. (2021). Boredom in online classes in the Iranian EFL context: sources and solutions. *System* 101:102556. doi: 10.1016/j.system.2021.102556

Diebel, P. L., and Gow, L. R. (2009). A comparative study of traditional instruction and distance education formats: student characteristics and preferences. *NACTA J.* 53, 8–14.

Garrison, D. R. (2006). Online collaboration principles. *J. Asynchr. Learn. Netw.* 10, 25–34. doi: 10.24059/olj.v10i1.1768

Garrison, D. R. (2007). Online community of inquiry review: Social, cognitive, and teaching presence issues. *J. Asynchr. Learn. Netw.* 11, 61–72.

Garrison, D. R. ed (2009). "Communities of inquiry in online learning," in *Encyclopedia of Distance Learning, Second Edition*, (IGI Global), 352–355. doi: 10.4018/978-1-60566-198-8.ch052

Garrison, D. R., Anderson, T., and Archer, W. (1999). Critical inquiry in a text-based environment: Computer conferencing in higher education. *Int. Higher Educ.* 2, 87–105. doi: 10.1016/s1096-7516(00)00016-6

Garrison, D. R., Cleveland-Innes, M., and Fung, T. S. (2010). Exploring causal relationships among teaching, cognitive and social presence: Student perceptions of the community of inquiry framework. *Int. High. Educ.* 13, 31–36. doi: 10.1016/j.iheduc.2009.10.002

Gonçalves, E., and Capucha, L. (2020). Student-centered and ICT-enabled learning models in veterinarian programs: What changed with COVID-19? *Educ. Sci.* 10, 1–17.

Hodges, C. B., Moore, S., Lockee, B. B., Trust, T., and Bond, M. A. (2020). *The difference between emergency remote teaching and online learning.* Available online at: https://er.educause.edu/articles/2020/3/the-difference-between-emergency-remote-teaching-and-online-learning [accessed on 20 Jul, 2022].

Hunzer, K. M. (ed.) (2014). *Collaborative learning and writing: Essays on using small groups in teaching English and composition.* Delhi: McFarland.

Irawan, A. W., Dwisona, D., and Lestari, M. (2020). Psychological impacts of students on online learning during the pandemic COVID-19. *KONSELI* 7, 53–60.

Ismailov, M., and Ono, Y. (2021). Assignment design and its effects on Japanese college freshmen's motivation in L2 emergency online courses: a qualitative study. *Asia Pacif. Educ. Res.* 30, 263–278.

Jensen, E. B. (2016). Peer-review writing workshops in college courses: Students' perspectives about online and classroom based workshops. *Soc. Sci.* 5:72. doi: 10.3390/socsci5040072

Johnson, S. D., Aragon, S. R., and Shaik, N. (2000). Comparative analysis of learner satisfaction and learning outcomes in online and face-to-face learning environments. *J. Interact. Learn. Res.* 11, 29–49.

Johnson, N., Veletsianos, G., and Seaman, J. (2020). U.S. faculty and administrators' experiences and approaches in the early weeks of the COVID-19 pandemic. *Online Learn.* 24, 6–21. doi: 10.24059/olj.v24i2.2285

Kassim, H., and Ali, F. (2010). English communicative events and skills needed at the workplace: Feedback from the industry. *Engl. Specif. Purposes* 29, 168–182. doi: 10.1186/s12913-016-1423-5

Kaur, I., and Joordens, S. (2021). The factors that make an online learning experience powerful: Their roles and the relationships amongst them. *Int. J. E Learn.* 20, 271–293.

Kohnke, L., and Har, F. (2022). Perusall Encourages Critical Engagement with Reading Texts. *RELC J.* 2022:00336882221112166.

Krippendorff, K. (2007). *Computing Krippendorff's alpha reliability.* Delhi: ASC.

Lowenthal, P., Bauer, C., and Chen, K. Z. (2015). Student perceptions of online learning: An analysis of online course evaluations. *Am. J. Dis. Educ.* 29, 85–97. doi: 10.1080/08923647.2015.10 23621

Mehlenbacher, B., Miller, C. R., Covington, D., and Larsen, J. S. (2000). Active and interactive learning online: A comparison of Web-based and conventional writing classes. *IEEE Transac. Prof. Commun.* 43, 166–184. doi: 10.1109/47.84 3644

Moore, J. L., Dickson-Deane, C., and Galyen, K. (2011). e-Learning, online learning, and distance learning environments: Are they the same? *Int. High. Educ.* 14, 129–135.

Morris, T. A. (2010). *Exploring community college student perceptions of online learning.* United States: Northcentral University.

National Center for Education Statistics [NCES] (2011). *Learning at a Distance: Undergraduate Enrollment in Distance Education Courses and Degree Programs.* Washingdon, DC: National Center for Education Statistics.

National Center for Education Statistics [NCES]. (2020). *The Condition of Education 2020.* Washingdon, DC: National Center for Education Statistics.

Naval History and Heritage Command. (2017). *Bravo Zulu.* Available online at: https://www.history.navy.mil/research/library/online-reading-room/title-list-alphabetically/t/terminology-and-nomenclature/bravo-zulu.html [accessed on 25, Jul, 2022]

Oppenheimer, D., Zaromb, F., Pomerantz, J. R., Williams, J. C., and Park, Y. S. (2017). Improvement of writing skills during college: A multi-year cross-sectional and longitudinal study of undergraduate writing performance. *Assess. Writ.* 32, 12–27.

Pandey, M., and Pandey, P. (2014). Better English for better employment opportunities. *Int. J. Multidiscip. Appr. Stud.* 1, 93–100.

Patthey-Chavez, G. G., and Ferris, D. R. (1997). Writing conferences and the weaving of multi-voiced texts in college composition. *Res. Teach. Engl.* 31, 51–90.

Phipps, R., and Merisotis, J. (1999). *What's the Difference? A review of contemporary research on the effectiveness of distance learning in higher education.* Washington, DC: Institute for Higher Education Policy.

Ritthipruek, J. (2018). "All on screen: The effects of digitized learning activities on increasing learner interest and engagement in EFL classroom," in *Proceedings of The Asian Conference on Education.* (Washingdon, DC: National Center for Education Statistics).

Sarikaya, İ (2021). Teaching writing in emergency distance education: the case of primary school teachers: Teaching writing in emergency distance education. *Int. J. Curricul. Instruct.* 13, 1923–1945.

Shim, T. E., and Lee, S. Y. (2020). College students' experience of emergency remote teaching due to COVID-19. *Child. Youth Serv. Rev.* 119:105578.

Tichavsky, L. P., Hunt, A. N., Driscoll, A., and Jicha, K. (2015). "It's just nice having a real teacher": Student perceptions of online versus face-to-face instruction. *Int. J. Scholarsh. Teach. Learn.* 9:2. doi: 10.20429/ijsotl.2015.090202

Trust, T., and Whalen, J. (2020). Should teachers be trained in emergency remote teaching? Lessons learned from the COVID-19 pandemic. *J. Technol. Teach. Educ.* 28, 189–199.

Van Viegen, S., and Russell, B. (2019). More than language—Evaluating a Canadian university EAP bridging program. *TESL Canad. J.* 36, 97–120. doi: 10.18806/tesl.v36i1.1304

Villacís, W. G. V., and Camacho, C. S. H. (2017). Learner-centered instruction: An approach to develop the speaking skill in English. *Rev. Publ.* 12, 379–389.

Weldy, T., Maes, J., and Harris, J. (2014). Process and practice: Improving writing ability, confidence in writing, and awareness of writing skills' importance. *J. Innov. Educ. Strateg.* 3, 12–26. doi: 10.1111/1460-6984.12762

West, R. E., Sansom, R., Nielson, J., Wright, G., Turley, R. S., Jensen, J., et al. (2021). Ideas for supporting student-centered stem learning through remote labs: a response. *Educ. Technol. Res. Devel.* 69, 263–268. doi: 10.1007/s11423-020-09905-y

Wikle, J. S., and West, R. E. (2019). An analysis of discussion forum participation and student learning outcomes. *Int. J. E Learn.* 18, 205–228.

Williamson, B., Eynon, R., and Potter, J. (2020). Pandemic politics, pedagogies and practices: Digital technologies and distance education during the coronavirus emergency. *Learn. Med. Technol.* 45, 107–114. doi: 10.1080/17439884.2020. 1761641

World Health Organization (2020). *Coronavirus disease 2019 (COVID-19). Situation report 43.* Geneva: WHO.

Augmented reality applications as a digital learning innovation in response to the pandemic

Hira Batool*

College of Graduate Studies, Walailak University, Tha Sala, Thailand

Augmented reality applications are digital learning innovations that can rapidly improve the learning of college and university students in the virtual setting. Ever since the beginning of the pandemic, on-site teaching has been pushed back to limit the spread of disease. This paper examines the attitudes and subjective and behavioral norms of 100 college students in Thailand toward digital learning innovations accessed through augmented reality applications. The study offers a theoretical model established through the theory of planned behavior (TPB) and uses it to investigate students' choices of augmented reality applications as digital learning innovations in their courses. The data were analyzed through structural equation modeling. The findings showed that students' acceptance of digital learning innovations through augmented reality applications could be explained through TPB wherever attitudinal and subjective factors showed significant influence; meanwhile, perceived behavioral control did not demonstrate a significant influence on college students. The findings acknowledge the positive effects of augmented reality applications as experienced by college students in Thailand.

KEYWORDS

digital, learning, innovation, augmented, Thailand

Introduction

The worldwide spread of COVID-19 is causing a great amount of devastation across many aspects of our society, especially education. The World Health Organization has confirmed COVID-19 as a global pandemic. The daily news reports highlight the ever-growing list of problems the pandemic is causing around the world, including its economic impacts (Rajmil et al., 2021). Educational institutions, in particular, are working to reduce the spread of COVID-19 and limit its effects on students' lives.

Despite the widespread diffusion of COVID-19, Thailand is comparatively affected by the pandemic (Ali et al., 2021). In response to the pandemic, Thai colleges and universities imposed a lockdown on face-to-face learning and announced learning and teaching would take place through several virtual channels (Hussain et al., 2022). However, due to the highly innovative nature of digital learning, numerous students face difficulties with participating in these environments (Tolentino et al., 2022). Both students and instructors have encountered significant challenges with the practical portions of many courses. For example, engineering and medical students

have experienced difficulties with online replacements for lab sessions that previously required in-person instruction (Mseleku, 2020).

Various authors have emphasized that the pandemic presents an opportunity for institutions to substantially revise their learning systems and, in doing so, re-center themselves and prepare for future change (Saleem et al., 2021). Maqableh and Alia (2021) recommended that learning institutions should implement innovative approaches to promote digital learning while eliminating the gaps that learners may encounter in accessing and using these environments. In this regard, information and communication technologies (ICT), especially augmented reality, can play a significant role in enhancing the digital learning experience and allowing students to achieve practical skills through this medium. Augmented reality allows students to deepen their knowledge and understanding of virtual objects *via* collaborative three-dimensional features and enhances users' participation *via* smart tools such as tablets (Wang et al., 2021). Nevertheless, it has been observed that augmented reality applications have been neglected by educational institutions (Psotka, 2022).

This paper discusses the potential of augmented reality applications to significantly improve college students' learning abilities, and abilities to demonstrate practical understanding, in the context of the COVID-19 pandemic. This paper intends to address gaps in knowledge by assessing students' attitudes toward digital learning *via* augmented reality applications.

This study used Google Excursions augmented reality applications, built by Google in 2015, as online teaching sources during the pandemic outbreak. These apps are designed to offer a simulated reality *via* smartphones connected with the institution (Pret and Cogan, 2018; Bourdin et al., 2021).

The theory of planned behavior (TPB) was used to analyze students' attitudes toward digital learning *via* these applications. Various authors have also applied TPB and its components to examine students' intentions toward the use of these applications in their learning (Balyk et al., 2021).

Therefore, three main research questions were proposed:

Q1: Do augmented reality applications have any impact on students' attitudes toward digital learning?

Q2: Do augmented reality applications have an impact on students' subjective norms regarding digital learning?

Q3: Do augmented reality applications have an impact on students' perceived behavioral control toward digital learning?

The current paper is innovative in that the theory of planned behavior has never before been used to assess attitudes toward augmented reality applications in Thailand. The results derived from this study add new insights to the literature on the challenges of conducting the practical portions of college courses within in the online domain.

Literature review

Augmented reality applications

In the current period of easily accessible advanced technology, the educational structure has become more varied. Novel tools, with their ability to facilitate interaction among learners and instructors, are now used in digital learning systems as empirical cognitive devices (Sudirman et al., 2020). Moreover, visualization delivered *via* intelligent devices, e.g., tablets, can perform important functions in many different situations and can be of use in overcoming the limitations of digital learning. Research has examined the influence of augmented reality applications on students' learning intentions (Wang et al., 2017) and has found that these applications can improve students' educational accomplishments and learning abilities as compared to conventional learning methods for all types of classes. For example, Shin (2018) claimed that several learners could not better understand their syllabus through traditional online systems. Thus, augmented reality applications play a significant role in constructing a strong link between students and instructors *via* 3D based applications for online learning.

Ozdimer et al. (2018) define augmented reality applications as those that create a three-dimensional reality that can present the digital world as a physical phenomenon. Collaborative technologies, i.e., augmented reality applications, enable students by offering solutions to the challenges they face. With these applications, students can enter the virtual setting, actively contribute, and relate to virtual things in the real world, increasing their three-dimensional abilities (Wang et al., 2021).

The hedonic value of augmented reality applications

Hedonic value, in simple terms, refers to the value perceived through real-time enjoyment and fun. Academic staff can ensure student satisfaction by providing real-time experiences through applications with hedonic value.

The hedonic value of an application involves providing digital experiences accompanied by real sensations that recall doing things in a physical setting. Doing lab experiments online, for example, can be just as enjoyable as digitally trying on makeup (Rab et al., 2013). The hedonic value itself allows these applications to provide real-time understanding to their users, improving playfulness (Zhong et al., 2021).

Wetzels et al. (2009) found that hedonic value is a highly significant part of augmented reality applications, triggering learners' rational and expressive approaches in a way that directly connects them with practical effects. Likewise, Iwanaga et al. (2021) examined students' logical- and emotional-based learning and understanding as significant factors in their intention to benefit from augmented reality–based education. Hedonic values promote real knowledge and the inspiration to gain it, including elements that affect students' commitment to the course (Haverila and Haverila, 2021). As an illustration from the literature, Arnold and Reynolds (2003) argued that hedonic value defines users' perceived behavioral control, which in turn influences their attitude and intention. It also improves the effectiveness of the course and maximizes students' understanding of it, thus defining the students' point of choice, such methods have been investigated with augmented reality systems by past author as well (Teo, 2011). This innovation looks at augmented reality applications offers a distinctive understanding level (Cheng, 2020). At the same time, a previous study reported that it offers stimulation, self-representation, pleasure, and hedonic practices (Chu et al., 2018). The hedonic aspect of augmented reality significantly influences students' behavioral intentions and attitudes toward digital learning (Khodadadi et al., 2020).

The utilitarian side of augmented reality applications

From a utilitarian perspective, augmented reality applications offer a logical and useful interaction with specific objects that can potentially influence the user's behavioral intentions (Novak et al., 2013). These applications hold strong potential as innovations in current or new digital learning systems (Hyde, 2019). It has been established that the utilitarian aspect can enhance objects' visibility and increase their recognition in a real-time environment, thus contributing to an optimistic attitude among users and their perceived intention to use the application (Novak et al., 2000). They can also improve the physical appearance of online courses, further engaging and inspiring students with regard to digital learning (Yimaz, 2016).

The pandemic has caused educational institutions around the world to shift to a digital-based education system. The utilitarian aspect of augmented reality increases the practicality of digital courses (Hyde, 2019) and therefore affects students' logical insights toward digital learning systems (Mi et al., 2020).

Numerous authors have analyzed the two aspects of augmented reality applications, i.e., the hedonic and the utilitarian, on users' behavioral intentions (Taipour et al., 2021).

Consequently, this study contends that the impact of augmented reality applications on students' behavioral intentions toward digital learning systems during the pandemic remains underexplored. The following hypotheses were

therefore proposed, positing augmented reality applications as a single independent variable and students' attitudes, subjective norms, and perceived behavioral control as three separate dependent variables. Each hypothesis is linked, respectively, to the corresponding research question posed in Section 1 above.

H1: Augmented reality applications have a positive impact on students' attitudes toward digital learning.

H2: Augmented reality applications have a positive impact on students' subjective norms toward digital learning.

H3: Augmented reality applications have a positive impact on students' perceived behavioral control with regard to digital learning.

Methodology

Data were collected from 100 college students in Thailand *via* convenience sampling. The minimum sample size was calculated through G*Power software, having three predictors with an effect size of 0.15 and a power of 0.95, with two tails that came to the minimum sample size of 89 (Faul et al., 2009). The sample size of this study is therefore above the minimum requirement. Students were contacted through a Facebook group set up by teachers to connect for assignments and lecture updates. A virtual survey form was distributed among the group members and voluntary contributions to the research were sought. Participants were instructed to install the Google Expeditions application on their tablets to experience online learning through augmented reality. A value check was employed in the form of an online survey that posed several appropriate questions about participants' familiarity with Google Expeditions and asked them to register their responses *via* a Likert scale. The question items were adapted from previous literature. The hedonic and utilitarian aspects were adapted from Khare et al. (2010) and Scholz and Duffy (2018). The TPB constructs, i.e., attitude, subjective norms, and perceived behavior control toward digital learning, were adapted from Khodadadi et al. (2020).

The data were analyzed through PLS(SEM) because of its potential to bootstrap the results into a larger sample size (Krishnan et al., 2011).

Results

To test the proposed hypothesis, the author first analyzed the collected data for demographic purposes. The results are

TABLE 1   Demographics of study participants.

		Frequency	Percent
Gender	Male	50	50%
	Female	50	50%
Age	18–25	50	50%
	26–34	50	50%
Study program	Undergraduate	50	50%
	Graduate	50	50%

presented in **Table 1**. As displayed in the table, the proportions of male and female participants were 50% each. Similarly, with regard to age, the two main groups were targeted in the university to cover both graduate- and undergraduate-level university students.

Reliability and validity

The items' convergent validity was assessed through Cronbach's Alpha, composite reliability (CR), and average variance extracted (AVE). Hair et al. (2010) stated that the value of an item should be 0.7 and above for the alpha, 0.8 and above for the composite reliability, and 0.5 and above for the AVE. The reliability values for the alpha, composite reliability, and AVE of the augmented reality application, as well as the utilitarian aspect, hedonic aspect, subjective norm, and perceived behavioral control, are presented in **Table 2**.

From **Table 2**, it can be seen that the augmented reality applications have an α of 0.755, a CR of 0.815, and an AVE of 0.656. The hedonic aspect has an α of 0.777, a CR of 0.965, and an AVE of 0.653. The subjective norm has an α of 0.762, a CR of 0.863, and an AVE of 0.679. Lastly, the perceived behavioral control has an α of 0.782, a CR of 0.780, and an AVE of 0.719. This means that the reliability standards of the adopted questionnaire have been satisfied and that it meets the standards of PLS for hypothesis testing.

To confirm the validity of the research questionnaire, it has been recommended to examine the diagonal and non-diagonal values in the correlational table of results; the non-diagonal values should be lower than the diagonal ones, or, put another way, the diagonal values should be higher than the non-diagonal values (Sarstedt et al., 2014). The validity aspects for the present study are reported in **Table 3**. The diagonal value for the attitude is 0.936; for the augmented application, 0.990; for the perceived behavioral control, 0.763; and for the subjective norm, 0.71. As all of these values are higher than the non-diagonal values, we can conclude that the adopted questionnaire was valid and reliable.

The results of the hypothesis testing are presented in **Table 4**. This study proposed three main research questions linked with three hypotheses, respectively. To answer these research

TABLE 2   Reliability values.

Measurement items	Loadings	α	CR	AVE
Augmented App Utilitarian aspect		0.755	0.815	0.656
UA1	0.782			
UA2	0.788			
UA3	0.758			
Hedonic Aspect				
HA1	0.828			
HA2	0.735			
HA3				
Attitude		0.777	0.965	0.653
ATU1	0.795			
ATU2	0.885			
ATU3	0.867			
Subjective Norm		0.762	0.863	0.679
SN1	0.862			
SN2	0.850			
SN3	0.843			
Perceived Behavioral Control		0.782	0.780	0.719
BC1	0.898			
BC2	0.771			
BC3	0.797			

α, Cronbach Alpha; CR, composite reliability; AVE, average variance extracted.

questions, there was a strong need to run bootstrapping tests on the collected data. As can be seen in **Table 4**, attitudes toward digital learning were tested within the context of augmented reality applications, and the *t*-value came out to 1.96 with a beta value of 0.725. Thus, hypothesis 1 has been confirmed; as the results demonstrate, augmented reality applications can play a positive role in changing students' attitudes toward digital learning. Similarly, the results support research question 2 and hypothesis 2, with a beta value of 0.729 and *t*-value of 1.99. We can therefore conclude that augmented reality applications play a positive role in changing students' subjective norms toward digital learning. However, the results did not support research question and hypothesis 3, because the *t*-value was lower than 1.96 and the beta value was also low. However, it was interesting to see that the existing relationship was positive, but at a very low intensity.

Discussion

This study intended to examine the characteristics of augmented reality applications in digital learning systems in Thailand during the pandemic by employing the theory of planned behavior. The findings showed that college students' attitudes and subjective norms influence digital learning through augmented reality applications. The beta value for

TABLE 3 Discriminant validity.

	1	2	3	4
1. Attitude toward digital learning	**0.936**			
2. Augmented reality applications	0.825	**0.990**		
3. Perceived behavioral control toward digital learning	0.745	0.753	**0.763**	
4. Subjective norms toward digital learning	0.481	0.769	0.442	**0.731**

It presents the discriminant validity of the proposed variables. The rule of thumb is that diagonal values should be greater than non-diagonal values. The bold values (i.e., those on the diagonal) are higher than the non-diagonal values. This confirms the convergent validity of the questionnaire.

TABLE 4 Hypothesis testing.

Hypothesis	β-values	t-values	Accept/Reject
AA → Attitude toward digital learning	0.725	1.96	H1 - yes
AA → Subjective norm toward digital learning	0.729	1.99	H2 - yes
AA → Perceived control toward digital learning	0.012	1.92	H3 - no

attitude came out to 0.725 with a t-value of 1.96, which means that there is a positive association between augmented reality applications and attitudes toward digital learning. This supports the first hypothesis and confirms the findings of previous authors (Chu et al., 2018; Chen, 2019). Similarly, the beta value for the second hypothesis comes out to 0.729, with a significant t-value of 1.99. The findings connected to this hypothesis are similar to the results of previous authors (Novak et al., 2000). However, perceived behavior control demonstrated a non-significant impact on digital learning through augmented reality applications, because the beta value (0.012) was lower, with an insignificant t-value of 1.92. A previous study by Yimaz (2016) had similar results for perceived behavioral control.

The integration of augmented reality applications into digital learning systems must be considered from a rational perspective. College students' use of augmented reality applications improves their knowledge, as these applications offer a three-dimensional presentation of the course. They also increase communication and improve outcomes, including maximizing students' knowledge. The present moment is thus an ideal time to entertain the idea of introducing this digital education method. Previous studies by Akçayır et al. (2016) and Chen (2019) highlighted the potential of digital learning approaches for improving the delivery of education. Cheon et al. (2012) suggested that augmented reality applications can improve the way students work with the course, as well as boost their confidence levels. However, these applications may not influence the students' perceived control.

As Yoo et al. (2021) discuss, most educational institutions have used conventional technologies (e.g., Zoom, Google Classroom) to operate online courses since the pandemic was declared. Classes held using these technologies most likely do not hold students' attention. Most people who

matter to students are against the use of augmented software for digital learning. Further investigation *via* qualitative analyses is needed to better understand this phenomenon.

The significant capabilities offered by these applications improve students' level of knowledge and reduce the psychological challenges posed by digital learning. Several digital learning networks have been launched since the start of the pandemic. As Saidin et al. (2015) stated, augmented reality applications represent the core principles of coursework that effectively help students perform their practical work. Augmented reality applications, and the collaborative capabilities they offer, add a distinctive element: the ability to bring the presence of simulated objects into the real world, with significant effects on users' recognition and composition.

Moreover, research on augmented reality applications in the context of an ASEAN country could be quite valuable for the relevant literature. Thailand is currently considered an emerging country in the context of the use of augmented reality applications in online education systems. This study addresses the challenges of providing a realistic learning experience for students, which were quite significant during the height of the pandemic. The augmented reality applications used for this study were Quiver, Element 4D, and Domino World AR, as the trial version to test their impact on students' learning experiences. Each of these applications was designed to bring life and physical reality to the virtual classroom setting. Additionally, they were found to be more engaging and made difficult subject matter easier, as per the findings of the research study.

More precisely: Quiver is used more for subjects in the natural sciences, as it allows the use of interactive 4D images. Similarly, Element 4D facilitates conducting practical experiments in a virtual setting. Domino World AR allows the instructor to create the course in the virtual setting by adding

interesting props to turn a serious lecture into an interesting one.

Lastly, three research questions were raised in the introduction to the present study. To answer those questions: the results of this study found that, in the case of students in Thailand, augmented reality applications do have a positive effect on their attitudes and subjective norms toward digital learning, but not on their perceived behavioral control.

Conclusion

This study explores the role of students' attitudes, subjective norms, and perceived behavioral control in adopting augmented reality applications for digital learning. The findings have shown that students play a strong role in digital learning through these applications. Lecture delivery through an augmented application boosts students' confidence and influences their attitudes and subjective norms. As a result of the pandemic, many learners face difficulties in joining online courses through traditional resources. Moreover, for higher education institutions and students in both affluent and developing nations, digital learning remains both a cultural problem and a tough technical dilemma. This research is limited to data sampling from one country. The results are therefore not generalizable to all levels of educational institutions or to all students. As a result, paths are open for future qualitative and quantitative studies, or both, to investigate factors that restrict and encourage the use of augmented reality applications in the delivery of education at various levels and across geographic contexts.

Limitations and future research potential

Due to the lack of sufficient time and resources, only data from Thailand were available. The generalizability of this study to other country contexts is therefore limited. Other researchers may want to use this study as an example for testing augmented reality applications in the context of other countries. Future investigators could also test other applications apart from those used in this study.

Contribution to theory and practice

This study contributed to the theory of planned behavior in the context of the challenge of converting virtual learning into a real experience by extending its use *via* augmented reality applications. In practice, this study, and its findings of proof of the effectiveness of these applications among students, can serve as an example and a source of motivation for educational researchers and institutions to move from the use of conventional digital learning applications to augmented reality applications.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors upon request, without undue reservation.

Author contributions

The author confirms being the sole contributor of this work and has approved it for publication.

Conflict of interest

The author declares that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note

All claims expressed in this article are solely those of the authors and do not necessarily represent those of their affiliated organizations, or those of the publisher, the editors and the reviewers. Any product that may be evaluated in this article, or claim that may be made by its manufacturer, is not guaranteed or endorsed by the publisher.

References

Akçayır, M., Akçayır, G., Pektaş, H. M., and Ocak, M. A. (2016). Augmented reality in science laboratories: The effects of augmented reality on university students' laboratory skills and attitudes toward science laboratories. *Comput. Hum. Behav.* 57, 334–342. doi: 10.1016/j.chb.2015.12.054

Ali, S. M., Malik, F., Anjum, M. S., Siddiqui, G. F., Anwar, M. N., Lam, S. S., et al. (2021). Exploring the linkage between PM2. 5 levels and COVID-19 spread and its implications for socio-economic circles. *Environ. Res.* 193:110421. doi: 10.1016/j.envres.2020.110421

Arnold, M. J., and Reynolds, K. E. (2003). Hedonic shopping motivations. *J. Retaili.* 79, 77–95. doi: 10.1016/S0022-4359(03)00007-1

Balyk, N., Grod, I., Vasylenko, Y., Shmyger, G., and Oleksiuk, V. (2021). The methodology of using augmented reality technology in the training of future computer science teachers. *Int. J. Res. E Learn.* 7, 1–20. 2 doi: 10.31261/IJREL.2021.7.1.05

Bourdin, S., Jeanne, L., Nadou, F., and Noiret, G. (2021). Does lockdown work? A spatial analysis of the spread and concentration of Covid-19 in Italy. *Reg. Stud.* 55, 1182–1193. doi: 10.1080/00343404.2021.1887471

Chen, Y. C. (2019). Effect of mobile augmented reality on learning performance, motivation, and math anxiety in a math course. *J. Educ. Comput. Res.* 57, 1695–1722. doi: 10.1177/0735633119854036

Cheng, Y. M. (2020). Understanding cloud ERP continuance intention and individual performance: A TTF-driven perspective. *Benchmark. Int. J.* 27, 1591–1614. doi: 10.1108/BIJ-05-2019-0208

Cheon, J., Lee, S., Crooks, S. M., and Song, J. (2012). An investigation of mobile learning readiness in higher education based on the theory of planned behavior. *Comput. Educ.* 59, 1054–1064. doi: 10.1016/j.compedu.2012.04.015

Chu, M., Matthews, J., and Love, P. E. (2018). Integrating mobile building information modeling and augmented reality systems: An experimental study. *Auto. Constr.* 85, 305–316. doi: 10.1016/j.autcon.2017.10.032

Faul, F., Erdfelder, E., Buchner, A., and Lang, A. G. (2009). Statistical power analyses using G* power 3.1: Tests for correlation and regression analyses. *Behav. Res. Methods* 41, 1149–1160. doi: 10.3758/BRM.41.4.1149

Hair, J. F., Ortinau, D. J., and Harrison, D. E. (2010). *Essentials of marketing research*, Vol. 2. New York, NY: McGraw-Hill/Irwin.

Haverila, M., and Haverila, K. C. (2021). The impact of the student-instructor relationship on student-centric measures. *J. Appl. Res. Higher Educ.* doi: 10.1108/JARHE-12-2020-0435 [Epub ahead of print].

Hussain, M., Ul-Allah, S., Binyameen, M., Jabran, K., and Farooq, M. (2022). COVID-19 and higher education in agriculture sector of developing countries: impacts and prospects. *Pedag. Res.* 7:1. doi: 10.29333/pr/11440

Hyde, G. (2019). *Modeling User Behavior To Construct Counter Strategies*. Ph. D, Thesis. University of Wisconsin–Whitewater.

Iwanaga, J., Loukas, M., Dumont, A. S., and Tubbs, R. S. (2021). A review of anatomy education during and after the COVID-19 pandemic: Revisiting traditional and modern methods to achieve future innovation. *Clin. Anat.* 34, 108–114. doi: 10.1002/ca.23655

Khare, A., Singh, S., and Khare, A. (2010). Innovativeness/novelty-seeking behavior as determinants of online shopping behavior among Indian youth. *J. Int. Commerce* 9, 164–185. doi: 10.1080/15332861.2010.529054

Khodadadi, E., Maroufi, P., Khodadadi, E., Esposito, I., Ganbarov, K., Espsoito, S., et al. (2020). Study of combining virtual screening and antiviral treatments of the sars-CoV-2 (Covid-19). *Microb. Pathog.* 146:104241. doi: 10.1016/j.micpath.2020.104241

Krishnan, A., Williams, L. J., McIntosh, A. R., and Abdi, H. (2011). Partial least squares (PLS) methods for neuroimaging: a tutorial and review. *Neuroimage* 56, 455–475. doi: 10.1016/j.neuroimage.2010.07.034

Maqableh, M., and Alia, M. (2021). Evaluation of online learning of undergraduate students under lockdown amidst COVID-19 pandemic: The online learning experience and students' satisfaction. *Child. Youth Serv. Rev.* 128:106160. doi: 10.1016/j.childyouth.2021.106160

Mi, T., Gou, M., Zhou, G., Gan, Y., and Schwarzer, R. (2020). Effects of planning and action control on smartphone security behavior. *Comput. Security* 97:101954. doi: 10.1016/j.cose.2020.101954

Mseleku, Z. (2020). A literature review of E-learning and E-teaching in the era of the Covid-19 pandemic. *SAGE* 57:6.

Novak, T. P., Hoffman, D. L., and Duhachek, A. (2013). The influence of goal-directed and experiential activities on online flow experiences. *J. Consumer Psychol.* 13, 3–16. doi: 10.1207/153276603768344744

Novak, T. P., Hoffman, D. L., and Yung, Y. F. (2000). Measuring the customer experience in online environments: A structural modeling approach. *Mark. Sci.* 19, 22–42. doi: 10.1287/mksc.19.1.22.15184

Ozdimer, M., Sahin, C., Arcagok, S., and Demir, M. K. (2018). The effect of augmented reality applications in the learning process: A meta-analysis study. *Eur. J. Educ. Res.* 18, 165–186. doi: 10.14689/ejer.2018.74.9

Pret, T., and Cogan, A. (2018). Artisan entrepreneurship: A systematic literature review and research agenda. *Int. J. Entrep. Behav. Res.* 25, 592–614. doi: 10.1108/IJEBR-03-2018-0178

Psotka, J. (2022). Exemplary online education: For whom online learning can work better. *Int. Learn. Environ.* 30, 199–201. doi: 10.1080/10494820.2022.2031065

Rajmil, L., Hjern, A., Boran, P., Gunnlaugsson, G., de Camargo, O. K., and Raman, S. (2021). Impact of lockdown and school closure on children's health and well-being during the first wave of COVID-19: A narrative review. *BMJ Pediatr. Open* 5:1. doi: 10.1136/bmjpo-2021-001043

Rab, A., Beitelspacher, L. S., Grewal, D., and Hughes, D. E. (2013). Understanding social media effects across seller, retailer, and consumer interactions. *J. Acad. Mark. Sci.* 41, 547–566. doi: 10.1007/s11747-013-0326-9

Saidin, N. F., Halim, N. D. A., and Yahaya, N. (2015). A review of research on augmented reality in education: Advantages and applications. *Int. Educ. Stud.* 8, 1–8. doi: 10.5539/ies.v8n13p1

Saleem, M., Kamarudin, S., Shoaib, H. M., and Nasar, A. (2021). Influence of augmented reality app on intention towards e-learning amidst COVID-19 pandemic. *Int. Learn. Environ.* 2021, 1–15. doi: 10.1080/10494820.2021.1919147

Sarstedt, M., Ringle, C. M., Smith, D., Reams, R., and Hair, J. F. (2014). Partial least squares structural equation modeling (PLS-SEM): A useful tool for family business researchers. *J. Family Bus. Strat.* 5, 105–115. doi: 10.1016/j.jfbs.2014.01.002

Scholz, J., and Duffy, K. (2018). We are at home: How augmented reality reshapes mobile marketing and consumer-brand relationships. *J. Retaili. Consumer Serv.* 44, 11–23. doi: 10.1016/j.jretconser.2018.05.004

Shin, D. (2018). Empathy and embodied experience in a virtual environment: To what extent can virtual reality stimulate empathy and embodied experience? *Comput. Hum. Behav.* 78, 64–73. doi: 10.1016/j.chb.2017.09.012

Sudirman, S., Mellawaty, M., Yaniawati, P., and Indrawan, R. (2020). *Integrating local wisdom forms in augmented reality application: Impact attitudes, motivations, and understanding of the geometry of pre-service mathematics teachers*. Chicago, IL: Sage. doi: 10.3991/ijim.v14i11.12183

Taipour, M., Demiryurek, K., and Abaci, N. I. (2021). Design the pattern of increasing satisfaction for international students: A qualitative study with the grounded theory approach. *Int. J. Manage. Educ.* 15, 458–476. doi: 10.1504/IJMIE.2021.117589

Teo, T. (2011). Factors influencing teachers' intention to use technology: Model development and test. *Comput. Educ.* 57, 2432–2440. doi: 10.1016/j.compedu.2011.06.008

Tolentino, J. C., Ortega, H. C., Abad, R., Castro, R., and Pusung, D. S. (2022). The hidden curriculum in a filipino pre-service physical educators' virtual ecology. *Educ. Sport. Indon. J. Phys. Educ.* 3, 25–40. doi: 10.25299/es:ijope.2022.vol3(1).8851

Wang, S., Kirillova, K., and Lehto, X. (2017). Reconciling unsatisfying tourism experiences: Message type effectiveness and the role of counterfactual thinking. *Tour. Manage.* 60, 233–243. doi: 10.1016/j.tourman.2016.12.008

Wang, T., Lin, C. L., and Su, Y. S. (2021). Continuance intention of university students and online learning during the COVID-19 pandemic: A modified expectation confirmation model perspective. *Sustainability* 13:4586. doi: 10.3390/su13084586

Wetzels, M., Odekerken-Schröder, G., and Oppen, C. V. (2009). Assessing using PLS path modeling hierarchical and empirical construct models: Guidelines. *MIS Q.* 33, 177–195.

Yimaz, R. M. (2016). Educational magic toys developed with augmented reality technology for early childhood education. *Comput. Hum. Behav.* 54, 240–248. doi: 10.1016/j.chb.2015.07.040

Yoo, H., Kim, D., and Lee, Y. M. (2021). Adaptations in anatomy education during COVID-19. *J. Korean Med. Sci.* 36:1. doi: 10.3346/jkms.2021.36.e13

Zhong, Y., Shapoval, V., and Busser, J. (2021). The role of parasocial relationship in social media marketing: Testing a model among baby boomers. *Int. J. Contemp. Hospit. Manage.* doi: 10.1108/IJCHM-08-2020-0873 [Epub ahead of print].

Frontiers in Education

Explores education and its importance for individuals and society

A multidisciplinary journal that explores research-based approaches to education for human development. It focuses on the global challenges and opportunities education faces, ultimately aiming to improve educational outcomes.

Discover the latest Research Topics

See more →

frontiers

Frontiers in
Education

frontiers | Research Topics