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# Exploring undergraduates' perceptions of and engagement in an AI-enhanced online course

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In the age of globalization, an internet connection has become essential for enhancing various human activities across the economic, cultural, and defense sectors, among others. This is particularly true for online classrooms. Microsoft Teams, a widely used digital education platform, provides capabilities that allow online teachers to facilitate better interactions and create more effective learning environments in online settings. This study aimed to explore students' perceptions of synchronous online learning that occurred in an AI-enhanced online course, delivered using MS Teams. As an explorative study that examines the educational intersection of engineering and artificial intelligence, it represents the convergence of these two branches of learning and thus enriches both fields. The research involved 35 online students at the Staffordshire University, with data collected via online questionnaires to gather information about students' perceptions of online learning through Microsoft Teams. After completing the online course materials, the questionnaires were distributed to students via Google Forms. The data were then descriptively analyzed. The study's findings revealed that although online learning through Microsoft Teams was a novel experience for the students, the platform's interactive and engaging learning environment motivated them to participate more actively, ultimately leading to a better comprehension of the course materials. Incorporating AI-enhanced features within the Microsoft Teams platform further augmented the online learning experience, as students appreciated the personalized learning recommendations and real-time feedback, which showcases the synergistic potential of AI and education in the digital age.

## KEYWORDS

Microsoft teams, AI classrooms, online learning, student perceptions, digital education  
Microsoft teams, digital education, educational atmosphere, communication

## 1 Introduction

In the age of global interconnectedness, internet access has become indispensable for advancing various aspects of human life, including the economy, culture, defense, and more (Fallows, 2004). The advent of online education, characterized by digital connectivity and instructional methods, has given rise to virtual or online learning platforms (Bentley et al., 2012). These platforms offer both opportunities and challenges, and it is essential to provide a balanced perspective on the subject.

Online education has witnessed remarkable growth, with one research study (Allen and Seaman, 2017) discovering a significant increase in the number of students participating in online higher education courses. In 2016, approximately 7 million students engaged in online education, compared to 1.7 million in 2003. This demonstrates the power of technology to enrich our lives, particularly in the realm of education (Oke and Fernandes, 2020). By harnessing technological advancements, educational experiences are no longer confined to traditional classrooms but can now span vast distances.

Two studies (Dorf, 1969; Feyzi Behnagh and Yasrebi, 2020) categorize educational technologies into instructional aids, educational materials, teaching settings, and pedagogical approaches. These technologies encompass both digital and analogue tools that facilitate learning via internet access, such as textbooks, instructional guides, and various teaching resources. They also offer diverse teaching settings, accommodating a range of locations, situations, and cultural contexts. Pedagogical strategies involve the effective presentation of subject matter, including methods like repetition, cooperative learning, and skills-based instruction.

Online learning provides a flexible and engaging educational setting (Nguyen, 2015; Ferri et al., 2020). It fosters an immersive educational atmosphere and replaces in-person interactions with virtual exchanges, offering convenience and adaptability (Bakerson et al., 2015; Bower et al., 2015; Steven et al., 2018; Smith et al., 2019; Landrum et al., 2021). However, it is essential to distinguish between synchronous and asynchronous learning environments, as they require different strategies for effective multiple dimensions of engagement and collaboration.

Online education comes with its set of challenges, such as the absence of physical cues for instructors and students, potential issues with engagement, and the need for self-driven motivation (Blumenfeld, 2002; Bakerson et al., 2015; Phillips and O'Flaherty, 2019). It is crucial to address these challenges while capitalizing on the opportunities online education presents. The choice of educational technology and the quality of learning materials play a pivotal role in the success of online education (Sebastianelli et al., 2015; Pérez-Pérez et al., 2020; Hamilton, 2022).

This paper will delve into students' experience of online education delivered using Microsoft Teams, a popular communication and collaboration platform that has gained significant traction in recent years, especially in the education sector. We explore how Microsoft Teams can facilitate student engagement, interaction, and the learning environment. Additionally, we consider both the advantages and limitations of this platform in the context of online education.

Our study aims to address two key questions:

- What is the nature of students' perceptions of internet-based education using Microsoft Teams?
- What is the nature of students' interactions with the learning environment when participating in online education through Microsoft Teams?

Online education has transformed the way we learn and access educational resources. While it offers tremendous opportunities for accessibility and flexibility, it also presents challenges that must be carefully navigated. This paper will explore these facets through the lens of Microsoft Teams, shedding light on the multifaceted nature of online education.

## 2 Study and course background

In order to provide a comprehensive understanding of the context in which this study was conducted, this section presents a description of the online course and a discussion of the role of AI technologies in facilitating the course.

### 2.1 Description of the course

The course under investigation, titled "Artificial Intelligence and Chatbots," was conducted at Staffordshire University and involved a cohort of 35 students. This course aims to provide level 4 students with a deep understanding of artificial intelligence principles and practical knowledge in building chatbots using Python programming. In the United Kingdom, Level 4 is considered the first stage of higher education, also known as the "first year of the undergraduate degree." Focused on the subject area of computer programming language learning, this online synchronous course intends to equip students with a thorough understanding of computer programming language concepts and enhance their skills in this domain. The curriculum encompassed fundamental concepts such as programming language, machine learning algorithms, and natural language processing which are crucial in the development of intelligent systems and chatbot applications. The course format follows a synchronous approach, where participants attend live sessions at scheduled times. This format allows for real-time interaction with the instructor and fellow students, fostering what appears to be an engaging learning environment characterized by active participation, questions, and immediate feedback. Domain. The course structure is comprised of a combination of lectures, hands-on coding exercises, and practical assignments. Students are encouraged to apply the theoretical knowledge gained during lectures to practical scenarios, allowing them to develop their computer programming language skills through real- world examples and projects.

To facilitate effective online learning, the course is delivered via Microsoft Teams, a digital education platform known for its interactive features and capabilities. Microsoft Teams provides a virtual classroom environment where students can engage in live class dynamics, fostering active participation and collaboration among the participants. By leveraging the interactive features of Microsoft Teams, the course appeared to encourage such a dynamic learning environment. Students had the opportunity to engage in real-time discussions, ask questions, and receive immediate feedback from both their peers and the instructor. As reported elsewhere, the platform facilitates seamless communication and enhanced student-teacher interactions, fostering a sense of community and active multiple dimensions of engagement within the virtual classroom (Aguilar and Torres, 2021; Kahu et al., 2022).

### 2.2 Role of artificial intelligence in the course

Artificial intelligence (AI) played a significant role in the "Artificial Intelligence and Chatbots" course at Staffordshire University, particularly in the context of aiding online learning. One of the

primary roles of AI in the course was to facilitate effective online communication and collaboration. Microsoft.

Teams leveraged AI-powered chatbots and natural language processing capabilities to enable real-time discussions among students and the instructor. Chatbots assisted in answering frequently asked questions, providing immediate feedback, and supporting students in navigating the course content. These AI features promoted active participation and multiple dimensions of engagement, ensuring that students had access to timely and relevant information (Lee et al., 2022; Bakare and Jatto, 2023). Additionally, AI-powered features within Microsoft Teams supported personalized learning experiences. The platform utilized AI algorithms to analyze students' interactions, preferences, and learning patterns, enabling the provision of tailored recommendations and resources. By understanding individual students' needs, it could suggest supplementary materials, practice exercises, or related resources to enhance their understanding of programming language concepts and chatbot development (Tran, 2021; Rajaram et al., 2022).

The role of Microsoft Teams, with its AI-powered features, went beyond simply providing a virtual classroom environment. It actively contributed to creating a collaborative and engaging learning ecosystem, where students could leverage AI capabilities to deepen their understanding of artificial intelligence and chatbot development. Students had access to personalized support, interactive discussions, and automated assessments, all of which enriched their learning experiences and facilitated their mastery of computer programming language concepts. In some ways, AI appeared to take on the supportive role of a tutor/instructor thus enhancing students' perceptions of the "real" instructor's sense of presence.

### 3 Methods

The aim of this study was to investigate the perceptions of undergraduate students regarding synchronous online learning conducted through Microsoft Teams. The research utilized a survey-based method to collect data from 35 online students who participated in an "Artificial Intelligence and Chatbots" course delivered via Microsoft Teams. The questionnaire was distributed to students after they completed the course, and the data were analyzed descriptively. The study aimed to explore students' perceptions of online learning and how these factors influenced their active participation and comprehension of the course materials. By examining students' perceptions and interactions with online learning through Microsoft Teams, this study aims to provide insights into the effectiveness of the platform in fostering collaboration, communication, and student engagement within the virtual classroom environment. Ethical approval for this study was obtained from the relevant sections at Staffordshire University before data collection commenced. The research procedures adhered to the ethical guidelines and principles for conducting research involving human participants, ensuring their confidentiality, privacy, and informed consent.

Data were collected using Google Forms, via an anonymous link to encourage open and honest responses. Participants did not receive any incentives or rewards for completing the survey. By ensuring the anonymity of the survey and not providing any incentives, we aimed to minimize any potential bias and encourage genuine responses from

the participants. We prioritized the ethical considerations of the study and aimed to maintain the integrity of the data collected.

### 3.1 Participants

The present study included a total of 35 undergraduate scholars at Staffordshire who were actively pursuing their bachelor's degrees. Among these participants, there were 27 males and 8 females enrolled in the course.

### 3.2 Instrument

The questionnaire was developed based on perception theories that were taken from the literature (Fortune et al., 2011; Gray and DiLoreto, 2016; Alnusairat et al., 2021; Rajabalee and Santally, 2021; Tsai et al., 2021). It was piloted to analyze internal consistency and reliability. Reliability was evaluated using Cronbach's alpha, and validity was evaluated using the Pearson correlation method. The questionnaire aimed to examine two primary aspects of students' perceptions: *Student engagement in virtual education* and *the educational atmosphere for students engaged in digital education*. Questions first were asked about the demographics of the students, including their age and gender. The survey then contained two sections, each of which had seven questions presented as affirmative statements to be rated on a five point-Likert scale ('Strongly Disagree,' 'Disagree,' 'No idea,' 'Agree,' and 'Strongly Agree'). The first set of seven questions/statements measured the students' perceptions of their engagement in the virtual course. Specifically, the questions related to: student interaction with teachers, comfort in expressing issues with online learning, digital education and virtual lessons generally, miscommunication, engagement among students, and navigating challenges in the virtual environment. The second set of seven questions/statements measured students' perceptions of the educational atmosphere. Specifically, the questions related to: students' comprehension of course content, the stimulating nature of the virtual classroom, the atmosphere of digital education generally, their comfort in answering questions, impact of the atmosphere on their education and educational requirements, and the conduciveness of the learning setting. The complete instrument is presented in [Appendix A](#).

Below, we discuss the types of validity assessed and the steps taken to develop and validate the questionnaire.

- **Content Validity:** Content validity refers to the extent to which the items in a questionnaire represent the entire construct or phenomenon being measured. In the development of the questionnaire, the researchers conducted an extensive literature review to identify relevant theories and concepts related to online learning, student engagement, and the educational atmosphere. This literature review helped ensure that the questionnaire's items were comprehensive and covered all the relevant dimensions of students' perceptions of online learning through Microsoft Teams.
- **Face Validity:** Face validity refers to the extent to which the questionnaire appears to measure what it intends to measure. Before administering the questionnaire to the target sample, a pilot test was conducted among a group of 20 students with characteristics similar to the participants. The purpose of the pilot

test was to assess whether the questionnaire items were clear, understandable, and relevant to the participants. Based on the feedback received during the pilot test, minor adjustments were made to the wording of some items to improve clarity and face validity.

- **Construct Validity:** Construct validity refers to the degree to which the questionnaire accurately measures the underlying constructs or variables of interest. In this study, construct validity was assessed by examining the relationships between the questionnaire items and the theoretical constructs they were supposed to measure. For example, items related to student engagement were expected to have positive correlations with each other, while items related to challenges in online communication were expected to have negative correlations with items related to the ease of communication. By conducting statistical analyses, such as correlation tests, the researchers were able to assess the construct validity of the questionnaire.
- **Criterion-Related Validity:** Criterion-related validity refers to the extent to which the scores obtained from the questionnaire can predict or relate to external criteria or outcomes. In this study, the researchers did not explicitly mention the use of external criteria to assess criterion-related validity. However, future research could consider comparing students' questionnaire responses with other measures of their academic performance or engagement to assess the extent to which the questionnaire's scores align with external criteria.
- **Reliability:** Reliability refers to the consistency and stability of the questionnaire's measurements. The researchers assessed reliability using Cronbach's alpha, which measures the internal consistency of the questionnaire items. A high Cronbach's alpha value indicates that the items in the questionnaire are closely related and measure the same construct. The pilot test conducted before the main study helped ensure the reliability of the questionnaire,

as it allowed the researchers to identify and address any issues with item clarity or consistency.

Table 1 presents the results of the assessment and reliability of the 14 questions on the questionnaire.

By following these steps, the researchers ensured that the data collected through the questionnaire were accurate and representative of students' perceptions of their online learning experiences through Microsoft Teams.

### 3.3 Procedures

A pilot test was conducted among a group of 20 students who shared the same characteristics as the target sample. The purpose was to preliminarily test the hypotheses, which led to testing more precise hypotheses in the main study. The results from this pilot indicated acceptable internal consistency and reliability of the test.

Following the pilot phase, the survey was administered to study participants toward the end of their experience in the course, "Artificial Intelligence and Chatbots." In addition to answering demographic questions, the 35 students were also asked to provide their opinions and perspectives on their digital educational learning experience in this comprehensive synchronous course through a set of 14 additional questions.

## 4 Results and recommendations for instructors

The examination of the students' responses to the questionnaire resulted in the following findings and data regarding (1) their perceptions of engagement in virtual education and (2) the educational atmosphere itself. Despite the absence of any notable significance, these results are useful in that they can point readers to expanded research opportunities regarding these two critical dimensions of online education.

Table 2 presents a frequency table of students' responses to the first seven questions related to engagement, which also are illustrated in Figure 1.

The results presented in Table 2 and Figure 1 indicate that students in this study generally had positive perceptions of their engagement in virtual education. In support of that general observation, here are the responses from the student participants to each of the first seven questions.

Survey question 1: *Virtual learning increased student interaction with teachers.* Out of 35 students, 9 indicated strongly agree, 14

TABLE 1 Assessing reliability and validity.

Survey questions	r value	Sig	r table	Result
1	0,720	0,000	0,363	Valid
2	0,842	0,000	0,363	Valid
3	0,883	0,000	0,363	Valid
4	0,433	0,022	0,363	Valid
5	0,744	0,000	0,363	Valid
6	0,804	0,000	0,363	Valid
7	0,535	0,005	0,363	Valid
8	0,753	0,000	0,363	Valid
9	0,866	0,000	0,363	Valid
10	0,716	0,000	0,363	Valid
11	0,807	0,000	0,363	Valid
12	0,575	0,003	0,363	Valid
13	0,778	0,000	0,363	Valid
14	0,777	0,000	0,363	Valid
Cronbach's Alpha		Critical point		Result
0,945		0,71		Reliable

TABLE 2 Frequency table for student engagement in virtual education.

No	Score	Criteria	Frequency						
			1	2	3	4	5	6	7
1	5	strongly agree	9	4	2	5	3	5	7
2	4	agree	14	6	14	11	22	7	11
3	3	neutral	3	7	2	3	1	7	5
4	2	disagree	8	16	8	13	3	13	10
5	1	strongly disagree	1	2	9	3	6	3	2
Total			35	35	35	35	35	35	35



## Student engagement in virtual education

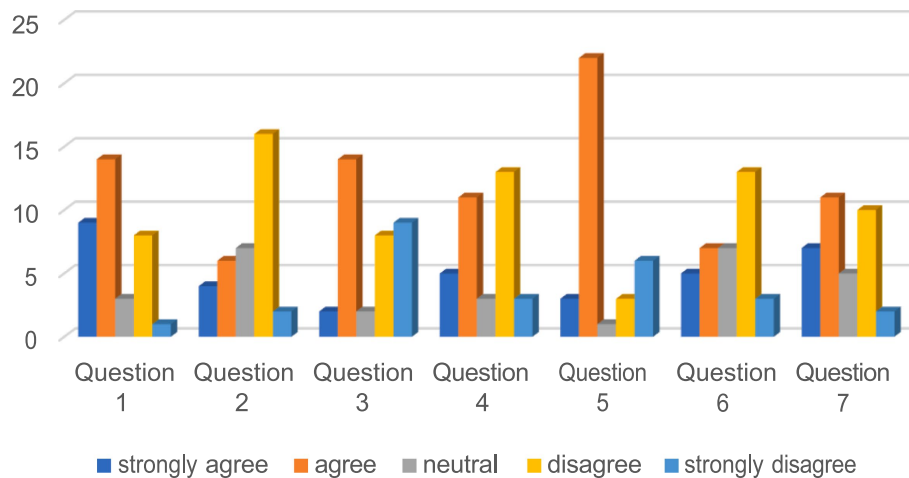


FIGURE 1

These data highlight the students' perceptions of engagement about different aspects of student engagement such as communication interactions with teachers and with other students. The figure displays the number of students who chose each option for each question. Responses were rated on a five-point Likert scale from strongly agree to strongly disagree. The figure displays the number of students who chose each option for each question.

expressed agree, 8 communicated disagreement, and 1 stated strongly disagree with the statement. These results suggest that considerably more than half the students experienced an increase in interactions with their instructors, despite what may be infrequent in-person interactions between students and instructors. Instructors using virtual learning platforms are well advised to keep in mind the importance of interactions as a means of establishing a sense of connection with all their virtual students.

Survey question 2: *It is more comfortable to express issues with online learning to the lecturers than in person.* Regarding this statement, 10 of 35 students indicated agree or strongly agree and 18 out of 35 students disagreed or strongly disagreed. These results suggest the majority of students may feel uncomfortable expressing issues with online learning to their teachers in digital learning environments, indicating a need for instructors to encourage students to express such issues more openly.

Survey question 3: *Digital education simplifies communication with instructors.* In response to this statement, out of 35 students, 2 indicated agree, 14 expressed strongly agree, 8 communicated disagreement, and 9 stated strongly disagree. These mixed results suggest there is much room for improvement in the digital education student experience and point to a need for further investigation into the obstacles to instructor student communication. As such investigation proceeds, instructors should continue to foster connections between students and instructors for effective knowledge transfer to occur.

Survey question 4: *Virtual lessons simplify student communication.* Out of 35 students, 5 indicated strongly agree, 11 expressed agree, 13 communicated disagreement, and 3 stated strongly disagree with the statement. Results from this question also show a dichotomy pointing to evidence that digital classes may pose communication challenges to student-to-student interactions for some students. Focusing on the those that disagreed or strongly disagreed, suggests that online instructors should pursue various approaches to virtual lessons and methods of interaction to simplify student communication.

Survey question 5: *The frequent occurrence of miscommunication in online courses between lecturers and students.* Out of 35 students, 3

indicated strongly agree, 22 expressed agree, 3 communicated disagreement, and 6 stated strongly disagree with the statement. These results indicate that a majority of students perceive miscommunication between lecturers and students, which is a serious concern for instructors. Given that this course mostly utilizes digital means of communication, more attention should be focused on the communication dimension of instructor communication competence and how that can be enhanced in digital learning environments.

Survey question 6: *In virtual classrooms, student engagement with one another intensifies.* Out of 35 students, 5 indicated strongly agree, 7 expressed agreement, 13 communicated disagreement, and 3 stated strongly disagree with the statement. These results suggest that virtual classrooms elicit a variety of opinions on student engagement with one another. Students may be unfamiliar or uncomfortable establishing interpersonal relationships in this context, such that instructors should consider including more interpersonal and group activities in their online courses.

Survey question 7: *In digital education, navigating challenges among students can become more manageable, such as when working on collaborative assignments.* Out of 35 students, 7 indicated strongly agree, 11 expressed agree, 10 communicated disagreement, and 2 stated strongly disagree with the statement. These results suggest the majority of students find collaborative assignments in digital education manageable. To address those who perceived navigational challenges among students, instructors need to clearly signal expectations for group interaction and engagement with one another.

Table 3 presents a frequency table of students' responses to the second set of seven questions, which are illustrated in Figure 2.

Survey question 8: *An online classroom setting facilitates comprehension of course content for me.* Out of 35 students, 7 indicated strongly agree, 9 agree, 11 communicated disagreement, and 1 stated strongly disagree. While these results indicate that more students agreed with this statement than disagreed, some students did report struggling with comprehending content in the digital setting, perhaps due to unfamiliarity with the technology. Identifying and addressing

the challenges students may face with comprehension is a matter of importance for online instructors.

Survey question 9: *The stimulating nature of the virtual classroom encourages my active engagement and comprehension of the content.* Of the 35 students surveyed, 7 agreed with this statement, 15 strongly agreed, 6 disagreed, and 1 strongly disagreed. These results demonstrate that substantially more than half of the respondents held a positive perception of the stimulating nature of the online educational atmosphere. The positive perception may be attributed to appealing resources, captivating visual aids, and enjoyable group exercises within the online framework. Instructors are advised to maximize their use of such resources.

Survey question 10: *The online learning atmosphere encourages me to pursue digital education.* In response to this statement, out of 35 students, 4 expressed strong agreement, 11 agreed, 7 disagreed, and 1 strongly agreed. The result that 12 students chose a neutral response suggests that students may think they have insufficient experience to think about digital education futuristically. However, of those who did

respond, more reported positively than negatively about pursuing more digital education. This finding bodes well for instructors interested in this educational context.

Survey question 11: *I feel comfortable answering questions in an online learning environment as an AI student.* Only 4 students strongly agreed with this statement but 15 agreed. Of the 35 students, 5 disagreed and 1 strongly disagreed. These results indicate that a majority of the students have a sense of comfort when responding to questions in the digital education environment. This finding may encourage instructors to pose more questions to students in any online course, but instructors should carefully consider whether the course is being delivered synchronously or asynchronously.

Survey question 12: *The online learning atmosphere significantly impacts my education.* This statement received mixed responses, with 13 out of 35 participants indicating neutrality and a nearly equal balance between agreement and disagreement. Strong agreement was expressed by 5 students, agreement by 5 students, 10 disagreed, and 2 strongly disagreed. These results suggest that the impact of the online learning atmosphere on education is highly variable among the students. The rapid rise of online learning may account for any clear sentiment related to impact, which reinforces the need to examine instructors' communication in online classes to enhance students' perceptions of the online learning atmosphere.

Survey question 13: *Online courses provide a conducive learning atmosphere that caters to my educational requirements.* This statement elicited 5 strongly agreed responses from students and 10 agreed responses. Disagreement was expressed by 9 students and strong disagreement by 2 students who may favor the direct inquiries and immediate assistance present in traditional settings. The number of positive responses shows more than half the students are supportive of online instruction and instructor's work. However, further investigation is warranted to uncover areas of online learning that do not cater to students' educational requirements.

TABLE 3 Frequency table for educational atmosphere in digital education.

No	Score	Criteria	Frequency						
			8	9	10	11	12	13	14
1	5	strongly agree	7	7	4	4	5	5	6
2	4	agree	9	15	11	15	5	10	7
3	3	neutral	7	6	12	10	13	9	11
4	2	disagree	11	6	7	5	10	9	10
5	1	strongly disagree	1	1	1	1	2	2	1
Total			35	35	35	35	35	35	35

### Educational atmosphere for students engaged in digital education

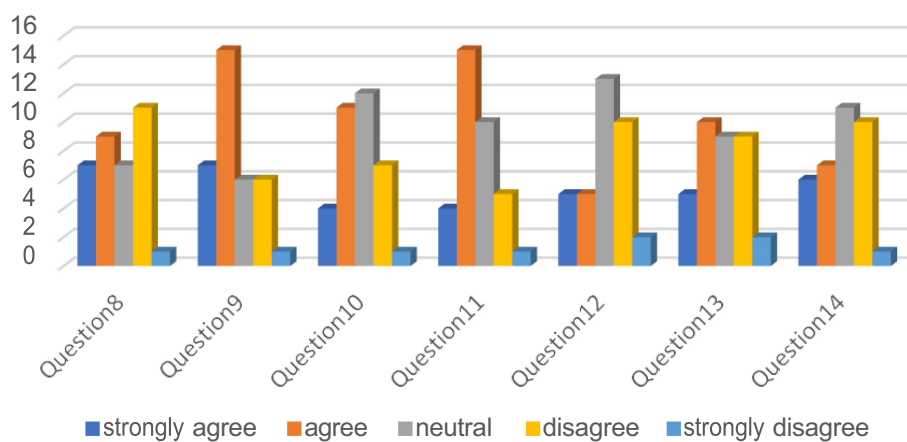


FIGURE 2

These data summarize students' perceptions of the educational atmosphere related to comprehension of course content. The survey asked seven questions about different aspects of the educational atmosphere, such as comprehension, engagement, influence, and comfort. The responses were rated on a five-point Likert scale from strongly agree to strongly disagree. The figure displays the number of students who chose each option for each question.

TABLE 4 Recommendations for instructors related to student engagement in virtual education and students' perceptions of educational atmosphere in digital education.

Categories	Question	Recommendations for instructors
student engagement in virtual education	1	Emphasize interaction to maintain a sense of connection with all virtual students.
	2	Encourage students to express issues with online learning openly.
	3	Foster instructor student communication and connections between students and instructors.
	4	Attend to challenges to student communication and approaches to virtual lessons that simplify student communication.
	5	Avoid miscommunication and pay attention to the communication dimension of instructor communication competence
	6	Include more interpersonal and group activities in online courses.
	7	Provide clear expectations for group interaction and student engagement with one another, their peers on social platforms.
The educational atmosphere for students engaged in digital education	8	Identify and address the challenges students may face with comprehension of content in online courses.
	9	Support a stimulating online educational atmosphere by using appealing resources, captivating visual aids, and enjoyable group exercises.
	10	Encourage students to pursue digital education, by enhancing the online learning atmosphere.
	11	Pose more questions to students in any online course.
	12	Communicate effectively in online classes to enhance students' perceptions of the online learning atmosphere.
	13	Continue to provide an online learning atmosphere that is conducive to students' accomplishment of their educational requirements.
	14	Continue to implement virtual education in the future, with a focus on a conducive learning setting.

Survey question 14: *It is advised to consider implementing virtual education moving forward, given its conducive learning setting.* Out of 35 students, 6 indicated strong agreement, 6 agreed, 10 disagreed, 1 strongly disagreed, and 11 expressed a neutral stance. The 11 students who disagreed (or strongly disagreed) may prefer in-person instruction where they can receive immediate evaluation from the instructor within the physical classroom. Given the nearly equal balance of positive and negative responses to this statement, instructors should cautiously move forward with virtual education efforts, while keeping in mind the results of this and other relevant research studies.

Table 4 presents a summary of the recommendations for online instructors derived from the students' responses to the 14 questions on this study's questionnaire.

## 5 Summative discussion of results

The summarized findings related to students' perceptions of their engagement in virtual education and the educational atmosphere in digital education suggest that such teaching and learning environments can indeed foster educational growth, to some extent (Ovbiagbonhia et al., 2019). In agreement with this notion, two other studies (Radovan and Makovec, 2015; Ameiratrini and Kurniawan, 2021) assert that a conducive learning setting is a vital component in stimulating students' eagerness to learn. Therefore, as the results of this study indicate, it is imperative to establish an inspiring and motivational learning space, which ultimately will enhance students' educational experience with learning virtually/digitally.

Managing student engagement within a virtual educational setting is crucial for fostering success in online learning. As such, interactions among students and between students and instructors must be promoted to enhance communication and dialog during each instructional activity. Two studies (Lin and Lin, 2015; Contreras et al., 2022) endorse this notion, emphasizing the importance of fostering both student-student and teacher-student interactions.

Other studies also (Peterson et al., 2018; Martin and Tapp, 2019; Roque-Hernández et al., 2021) and (Sayeg-Sánchez et al., 2022) found that the use of real-time learning methods has improved student engagement and collaborative education, allowing for more comprehensive access to learning materials. However, the current findings also indicate that 46% of students do not believe online lectures effectively facilitate interaction and collaboration. To address this limitation of real-time learning, educators should incorporate engaging activities and approachable tasks to encourage active participation and collaboration in online learning environments.

Yet more studies (Poston et al., 2020; Yang et al., 2022) and (Kerkstra et al., 2022) suggest that the use of Microsoft Teams is particularly advantageous in smaller class sizes, enabling students to work together on collaborative projects using PowerPoint. Educators must ensure that students have a solid grasp of how to utilize Teams for online courses (Silva et al., 2022). Students in this study reported feeling at ease when responding to questions and collaborating on assignments, thanks to engaging content. In this present study, students' active involvement in learning AI and programming online was fueled by the novelty and challenge of the subject matter.

The study observed that the use of the Microsoft Teams platform positively influenced student engagement, interaction, and overall learning experience in the online course. The platform's distinctive capabilities, such as real-time video conferencing, chat functionality, and document collaboration, facilitated active participation and meaningful communication among students, contributing to a more effective learning environment.

## 6 Limitations, conclusion, and recommendations

The authors acknowledge the limitations of their current study and propose ways to strengthen the research by involving a larger and more diverse sample, conducting replicative studies in other disciplines,

employing statistical significance tests, and integrating qualitative methods and data. In addition, future studies should consider rewording several questions to avoid “leading” students’ responses and to ensure that the results indicate more clearly whether the impact is “negative” or “positive.” The authors also want to emphasize the exploratory nature of their research and suggest that future studies should aim to replicate but also extend this present study to establish broader trends and patterns. For example, in this study the role of artificial intelligence and chatbots in the course was likely an influencing factor on students’ perceptions that was not explored as such here. Given increased interest in AI in higher education, AI’s influence on online communication and collaboration is an avenue ripe for investigation. By adopting these recommendations, the study’s findings can become more useful and applicable, providing valuable insights into students’ perceptions and engagement in AI-enhanced online courses delivered using Microsoft Teams.

Although the study sample size was small, it nonetheless provided further insight into students’ views on digital education. Upcoming studies should delve deeper into the significance of student engagement and the role of the virtual learning space in e-learning. Further inquiries might extend the student population to encompass a wider range of academic disciplines and educational levels. Prospective qualitative investigations could emphasize students’ perspectives, attitudes, and satisfaction regarding virtual classes, as well as the advantages of engaging in digital education through Microsoft Teams. Examining student interactions and the educational setting is also recommended to determine the effects on students’ success in virtual learning environments. Overall, results from this study support the use of virtual classrooms and provide further evidence that using Microsoft Teams can effectively enhance the educational atmosphere for students and foster communication among peers and between students and instructors.

## 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.

## Ethics statement

Ethical approval was not required for the study involving human participants in accordance with the local legislation and institutional

requirements. Written informed consent to participate in this study was not required from the participants in accordance with the national legislation and the institutional requirements.

## Author contributions

All authors contributed equally to this work. They were involved in the conception and design of the study, data collection, analysis, and interpretation of the results. They collaborated closely in drafting and revising the manuscript, providing critical intellectual content, and ensuring its accuracy and scientific rigor. Additionally, all authors approved the final version of the manuscript for publication and agreed to be accountable for all aspects of the work. The collective efforts and contributions of all authors were essential in carrying out this research and producing the final manuscript.

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## 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.

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## Appendix A

Dear Learner,

This questionnaire, which is composed of two parts, aims to examine AI learners' perceptions of online learning. The information will be kept confidential and will be used just for research purposes. Thank you very much in advance for your time and cooperation.

PART A: Personal data.

Age:

Gender: female  male .

PART B. Please read each statement and tick the response that best describes your perception for online learning as an AI student:

1 = Strongly Disagree.

2 = Disagree.

3 = No idea.

4 = Agree.

5 = Strongly Agree.

Categories	Question	1	2	3	4	5	
Student engagement in virtual education	1	Virtual learning increased student interaction with teachers					
	2	It is more comfortable to express issues with online learning to the lecturers than in person.					
	3	Digital education simplifies communication with instructors.					
	4	Virtual lessons simplify student communication.					
	5	The frequent occurrence of miscommunication in online courses between lecturers and students.					
	6	In virtual classrooms, student engagement with one another intensifies.					
	7	In digital education, navigating challenges among learners can become more manageable, such as when working on collaborative assignments.					
The educational atmosphere for students engaged in digital education	8	An online classroom setting facilitates comprehension of course content for me.					
	9	The stimulating nature of the virtual classroom encourages my active engagement and comprehension of the content.					
	10	The online learning atmosphere encourages me to pursue digital education.					
	11	I feel comfortable answering questions in an online learning environment as an AI student.					
	12	The online learning atmosphere significantly impacts my education.					
	13	Online courses provide a conducive learning atmosphere that caters to my educational requirements					
	14	It is advised to consider implementing virtual education moving forward, given its conducive learning setting.					