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Development of a community-based social collaborative e-learning model for adaptability of higher education students in Indonesia

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Introduction: The rapid evolution of educational needs in the 21st century calls for innovative models that enhance students' adaptability to dynamic socio-cultural and professional environments. This study aims to develop and evaluate the model's effectiveness as a community-based social collaborative e-learning model designed to improve the cognitive, behavioral, and emotional adaptability of higher education students in Indonesia.

Methods: The study used a Research and Development (R&D) approach that involved three phases: needs analysis, model development, and testing. The study involved three phases: needs analysis, model development, and testing. The study involved 300 students, 45 males and 255 females, from three universities in Central Java, Indonesia. Data were collected through surveys, interviews, and pre- and post-intervention assessments. Quantitative data were analyzed using descriptive statistics and paired *t*-tests, while qualitative data were interpreted through thematic analysis.

Results: The study results demonstrated a substantial increase in student adaptability by implementing the community-based social collaborative e-learning model, supported by technology as a key learning resource. This improvement was evidenced by a significant rise in the adaptability scores, with an average pre-intervention score of 41.92 and a post-intervention score of 48.87. Key factors influencing this adaptability enhancement included literacy skills, the ability to critically analyze phenomena, effective collaboration in social projects, strong social interaction skills, and problem-solving capabilities. These results underscore the model's effectiveness in fostering critical competencies for dynamic and collaborative learning environments. However, limitations such as digital infrastructure disparities, the absence of adaptive mechanisms for diverse learning styles, and the need for long-term evaluation of adaptability improvements were identified.

Conclusion: The community-based social collaborative e-learning model offers a robust framework for enhancing student adaptability in Indonesia's higher education system. While the model demonstrates significant potential, addressing its limitations and expanding its scalability to varied educational

contexts are necessary for maximizing its impact. This study provides a foundation for innovative educational practices that prepare students to thrive in dynamic, interconnected global and local landscapes.

KEYWORDS

adaptability, social collaboration, community participation, e-learning, higher education

1 Introduction

Adaptability in education is increasingly recognized as a cornerstone of success in a world of constant change. Higher-order thinking skills (HOTS), such as critical thinking, creativity, and problem-solving, are essential for students to succeed in an interconnected and dynamic world (Gedera, 2023). Adaptability is the ability to effectively adjust to new learning environments, and challenges are critical for fostering lifelong learners who can thrive in an ever-changing world. The rapid pace of globalization and digital transformation has reshaped higher education globally, and in Indonesia, these shifts are further complicated by unique socio-cultural dynamics. While e-learning platforms are increasingly used to bridge gaps in geography and infrastructure, traditional approaches often fail to address the diverse needs of Indonesian students, particularly in underserved areas (Muhammad and Utomo, 2024).

For Indonesian higher education students, particularly those enrolled in Primary School Teacher Education (PGSD) programs, adaptability also involves overcoming language barriers in accessing global resources, coping with the demands of interdisciplinary learning, and transitioning from traditional classroom settings to digital platforms (Stockinger et al., 2021; Sirotiak and Sharma, 2019; Martens and Lairamore, 2016). These challenges have been further exacerbated by the COVID-19 pandemic, which abruptly shifted the educational landscape and underscored the need for resilient and flexible learning models (Pratama et al., 2020).

Community-based learning is one of the models that emphasizes the collective strengths and shared experiences of a group, fostering a sense of belonging and mutual support. In parallel, social collaborative learning focuses on active interaction, dialogue, and student cooperation to achieve common educational goals (Purbasari et al., 2023). When combined, these approaches create an ecosystem that nurtures not only cognitive development but also emotional resilience and adaptability. Such a model aligns well with Indonesian values, which prioritize communal harmony and interdependence while also addressing the individual needs of students navigating the complexities of higher education (Putrawangsa and Hasanah, 2018; Hidayat, 2016).

Integrating cognitive adaptation and social collaboration within educational models has garnered increasing attention, particularly in addressing the challenges of modern learning environments. Cognitive adaptation refers to the capacity of learners to adjust their thinking processes to respond effectively to changing circumstances (Bullock et al., 2022; Nesterova, 2017; Crisp and Turner, 2011). At the same time, social collaboration emphasizes cooperative interactions that enhance collective problem-solving and skill development (Anoir and Khaldi, 2024).

The research on developing a community-based social collaborative e-learning model is rooted in the understanding that adaptability is not an innate trait but a skill that can be cultivated through deliberate educational practices (Baharuddin, 2021; Jalinus et al., 2021). By leveraging the principles of community-based and social collaborative learning, this model aims to create a dynamic, inclusive, and student-centered learning environment (Chang et al., 2018; Dunbar et al., 2018). Such an approach not only enhances adaptability but also addresses broader educational goals, such as fostering digital literacy, critical thinking, and social responsibility.

The theoretical underpinnings of this research draw from established frameworks in educational psychology, digital pedagogy, and socio-cultural theory. Vygotsky's theory of social constructivism, which emphasizes the role of social interaction in cognitive development, provides a foundational lens for understanding the potential of collaborative e-learning holistically (Zhang et al., 2021; Perry and Dockett, 2018). Additionally, the community of inquiry model, which highlights the interplay of social, cognitive, and teaching presence in online learning environments, offers valuable insights into designing effective e-learning ecosystems. These theories, when contextualized within Indonesia's educational landscape, can inform the development of a robust and scalable model.

Therefore, the study focuses on developing a community-based social collaborative e-learning model tailored to Indonesia's educational context. By combining community-based learning, which emphasizes collective strengths and shared experiences, with social collaboration, which fosters dialogue and cooperative problem-solving, the model seeks to enhance students' adaptability while addressing systemic challenges. The model aligns with the principles of situated learning and communities of practice, offering students authentic, contextually relevant opportunities to develop critical skills and competencies. This study investigates how a community-based social collaborative e-learning model can address the challenges of language barriers, regional inequalities, and digital transformation to enhance adaptability in Indonesian higher education. It also analyzes the impact of these challenges, designs a culturally relevant and inclusive model, and evaluates its effectiveness in fostering adaptability. By bridging these gaps, the study contributes to broader educational goals by fostering lifelong learning, advancing digital literacy, and promoting social responsibility.

TABLE 1 Needs analysis instrument (Cronbach Alpha = 0.80).

Item	Mean	SD	Corrected item–total correlation
CA1	4.2	0.76	0.68
CA2	4.1	0.82	0.63
CA3	4.0	0.85	0.66
CA4	4.3	0.79	0.70
CA5	4.1	0.81	0.69
BA1	4.0	0.83	0.64
BA2	3.9	0.88	0.62
BA3	4.2	0.80	0.67
BA4	4.1	0.84	0.65
BA5	4.0	0.86	0.63
EA1	4.3	0.78	0.71
EA2	4.2	0.79	0.70
EA3	4.1	0.82	0.69
EA4	4.3	0.76	0.72
EA5	4.2	0.81	0.68

2 Materials and methods

2.1 Research procedure

This is a research and development of a community-based social collaborative e-learning model conducted at three universities in Central Java, Indonesia, in the odd semester of 2023/2024. The research adopted Gall et al. (1996) model, the stages included needs analysis, model design, model development, and limited model trials. Each stage was evaluated using predetermined instruments.

In the needs analysis stage, the social collaboration of 143 undergraduate students who had passed the social science course was identified using an instrument consisting of 15-item questions (Table 1). The questions were adapted from Andriessen et al. (2013) and validated by three social science lecturers. To measure the needs and perceptions of higher education students regarding adaptability in a community-based social collaborative e-learning environment. The instrument assesses three dimensions of adaptability: cognitive adaptability (CA), behavioral adaptability (BA), and emotional adaptability (EA). Responses were collected using a five-point Likert scale: 1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, and 5 = Strongly Agree.

The model design stage aims to determine product specifications, define achievable competencies, formulate objectives, and determine learning stages. Based on the data from the needs analysis stage, the specifications of the social, collaborative e-learning learning model include learning tools, learning technology tools related to e-learning design via educational websites, and teaching materials for the social studies course based on local industrial community participation. The design was validated by 6 experts in learning design, learning media, social learning materials, IT experts, language and psychology experts. The social adaptation capability instrument were adapted from Andriessen et al. (2013), and validated by three social science lecturers. The design was tested on 50 students who had passed the social science course. The pilot testing was conducted using the one-to-one technique and interviews.

The model development stage aims to develop a community-based social collaborative e-learning model. At this stage, media and material expert validation is carried out. Media validation ensures that the application display is easy to use and attractive, while material validation ensures that the content presented is accurate and relevant to the curriculum. This training model was validated by three experts to evaluate the feasibility of the media and the truth of the material. After going through the validation process, the community-based social collaborative e-learning model was distributed to 247 students to obtain input on the practicality of the community-based training model.

The study utilized a random sampling approach to select participants from three universities in Central Java. To avoid sampling bias and ensure a representative sample of the student population, the sample selection process involves stratified random sampling. This begins by dividing the population into distinct strata based on key characteristics, such as institution, gender, or program, ensuring that all subgroups are proportionately represented. This method was chosen to minimize selection bias and enhance the generalizability of the findings. A total of 247 students participated, with samples drawn proportionally from the three universities in Central Java. The inclusion criteria for participants required enrollment in a Primary School Teacher Education (PGSD) program and prior completion of a social studies course. This ensured all participants possessed foundational knowledge relevant to the study's objectives. Additionally, participants demonstrated willingness and availability to complete the intervention activities within the study's 16 weeks timeframe. This study employs an experiment design of One Group Pre-Post Intervention Design to determine the influence of pre-intervention and post-intervention results in the same group. Before the implementation of learning, researchers, along with teaching lecturers and practitioners, conducted a focus group discussion (FGD) to discuss curriculum documents in the form of syllabus and semester learning plans to examine learning achievements and Course Learning Achievements until the main topic of the Social Studies Concept course was obtained. Researchers also monitored the implementation of learning to ensure that activities were running according to the expected objectives.

Pre-intervention was conducted on class groups that used the ongoing learning model. Post-intervention was conducted on the same group that had received treatment of the social, collaborative e-learning learning model based on the participation of local industrial communities in social science learning with a total period are 16 weeks based on the Indonesian university requirement for one semester. During the periods, students participate in learning activities during 10 face-to-face meetings, with each meeting lasting 170 min and six online sessions, with each session lasting 110 min. In the first two face-to-face sessions, students participated in orientation activities, where they were introduced to the model's goals and the importance of adaptability. Collaborative workshops emphasized understanding group dynamics, critical thinking, and goal-setting techniques

TABLE 2 Reliability statistics.

Cronbach's Alpha	Ns of items
0.70	15

relevant to social projects. Over three sessions (two face-to-face and one online), students engaged with local community members, such as practitioners from traditional industries, to explore real-world social problems. Activities included field visits, interviews, and data collection designed to improve cognitive adaptability by connecting theoretical concepts with practical applications. For social interaction and collaboration, activities spanned four sessions (three face-to-face and one online). Students worked in groups to develop solutions to the identified social problems, practising behavioral adaptability by negotiating roles, resolving conflicts, and maintaining active participation. Virtual collaborative tools, such as shared documents and online discussion forums, facilitated asynchronous interaction.

Across four sessions (two face-to-face and two online), students participated in problem-solving workshops guided by lecturers and community mentors. Activities focused on scenario analysis, decision-making simulations, and creating prototypes or project plans. Emotional adaptability was emphasized through feedback cycles and peer evaluations, fostering resilience and positive interpersonal interactions. In the final three sessions (one face-to-face and two online), students presented their projects to peers, lecturers, and community stakeholders. The presentations were followed by reflective discussions to assess individual and group adaptability growth. Feedback from stakeholders highlighted the practical relevance of students' work and reinforced their confidence in applying adaptability skills beyond the classroom. While the items consist of 15 statements contained in the social adaptation capability instrument which are declared reliable based on the Cronbach Alpha test with a significance value > 0.06 (Table 2). The reliability analysis results using Cronbach alpha were 0.70, categorized as reliable.

2.2 Subject

This study involved 300 students, comprising 45 males and 255 females from three universities in Central Java, Indonesia, who had completed social studies courses in the odd semester of the 2023/2024 academic year. In addition, six experts, comprising lecturers and practitioners, were engaged to validate the social collaborative e-learning model based on community participation within the context of social science learning. Their expertise ensured the model's relevance, accuracy, and applicability by evaluating its design, content, and alignment with educational objectives. This validation process was instrumental in refining the model and enhancing its effectiveness for practical implementation. The demography of the participants of the study can be seen in Table 3.

Based on Figure 1, 143 students participated in the needs analysis phase, which aims to identify the requirements and contextual factors that are important for designing a social collaborative e-learning model. Furthermore, 50 students were involved in pilot testing of the instrument and application model.

TABLE 3 Participant demography.

	Gender		Amount
	Male	Female	
University 1	25	125	150
University 2	5	45	50
University 3	15	85	100
Total	45	255	300

Finally, 247 students participated in testing the effectiveness of the model.

2.3Data source and data analysis

The data sources for this study included both primary and secondary data collected to evaluate the social collaborative e-learning model based on community participation. Primary data were obtained through surveys, interviews, and observations involving students, lecturers, and practitioners from local industrial communities. The participants were selected from three universities that all of which are situated in the Central Java region. These institutions provided access to a diverse cohort of elementary school teacher education students and practitioners from local industries producing traditional children's toys, ensuring a contextual and culturally relevant dataset. Secondary data comprised literature and theoretical studies related to collaborative learning, social adaptability, and e-learning integration. These sources included academic journals, policy documents, and previous research that informed the theoretical framework and supported the validation and implementation phases of the model.

The data analysis involved both qualitative and quantitative methods to ensure a comprehensive evaluation of the model's feasibility and effectiveness. Qualitative data from interviews, observations, and documentation were analyzed using thematic analysis to identify recurring patterns and themes relevant to the development and implementation of the model. This process helped refine the model by aligning it with the participants' needs and contextual realities. Quantitative data were derived from surveys and pre- and post-intervention assessments. Descriptive statistics were used to summarize the participants' responses, while inferential statistical tests, such as paired *t*-tests and N-gain analyses, were conducted to evaluate the model's impact on students' social adaptability. These analyses measured changes in cognitive, behavioral, and emotional adaptability before and after the implementation of the model. The combination of qualitative and quantitative methods ensured a robust evaluation, providing insights into the model's applicability, relevance, and effectiveness in fostering social adaptability among students.

3 Results

The needs analysis of the model was identified through a learning questionnaire consisting of aspects of the implementation

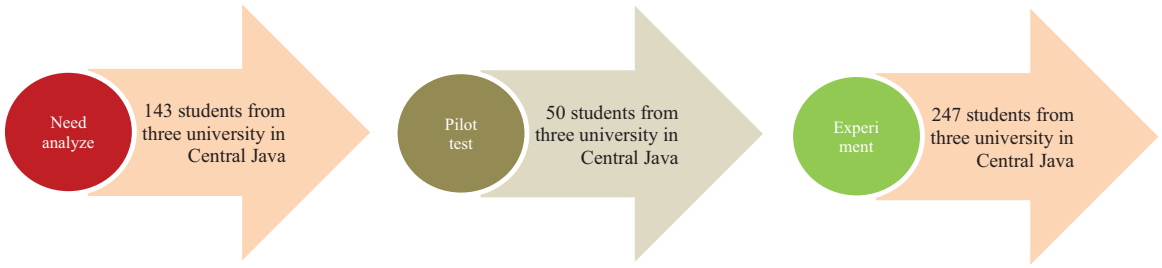


FIGURE 1
Research subject.

of learning activities, material understanding, learning media, problem-solving skills, and evaluation of learning results. Based on Figure 2, the needs analysis data of the model shows that 66% of students use textual references, 58% of understanding of social concepts is still abstract, 47% of lecture activities still use classroom learning, and 48% of students have low adaptability. It can be concluded that developing a social collaborative e-learning model based on community participation is needed in the Social Studies course. The construction of the model development refers to social constructivism learning theory, which involves the social environment as a learning resource facilitator.

The development of the social collaborative e-learning model includes developing a model framework based on transformative education according to the needs of global phenomena with mastery of technology and social problem-solving. The social collaborative e-learning learning model based on community participation has several syntaxes, including orientation, discovery, collaboration, social interaction, problem-solving, evaluation, and publication (Sotto, 2021; Ghavifekr, 2020; Lin and Reigeluth, 2016; Cress et al., 2015). The stages of the social collaborative e-learning model based on community participation are described in Figure 3.

Validation of the social collaborative e-learning model design based on community participation is reviewed from several aspects, including the accuracy of the model on course outcomes, the suitability of the strategy, the effectiveness of the model stages, the suitability of the method, and the accuracy of lecture evaluation (Arrasyid et al., 2020). The results of validating the social collaborative e-learning model based on community participation show that the validity value is 0.70, so the model is very feasible to use in social studies lectures. The results of the model reliability test on 50 students with a significance value > 0.06. Learning models that combine context learning with community collaboration and the use of technology encourage student performance productivity in constructing knowledge (Vega et al., 2020; Järvelä et al., 2015; Melissourgos et al., 2015). Situated learning experiences in uncertain conditions train critical analytical skills and communication competencies, manage social interactions and practice problem-solving in academic and non-academic learning environments. In this study, the observed increase in adaptability among students aligns with this theory, as the community-based social collaborative e-learning model creates environments where students and local stakeholders engage in practical, context-specific projects. These collaborative interactions foster knowledge sharing, collective problem-solving, and mutual learning, supporting the principles of communities of practice.

The limited model trial stage was conducted to see the effectiveness of the community-based social collaborative e-learning model. As mentioned, the study used One Group Pre-Post Intervention Design to determine the influence of pre-intervention and post-intervention results in the same group. Pre-intervention was conducted on class groups that used the ongoing learning model. Post-intervention was conducted on the same group that had received treatment of the social, collaborative e-learning learning model based on the participation of local industrial communities in social science learning with a total period are 16 weeks. During the periods, students participate in learning activities in 10 face-to-face meetings, with each meeting lasting 170 min and six online sessions, with each session lasting 110 min. At the end of the period, students completed a questionnaire to evaluate their learning experience and the effectiveness of the application model. N-Gain analysis evaluated changes using the community-based social collaborative e-learning model before and after the treatment.

Table 4 illustrates the results of implementing the community-based social collaborative e-learning model on students' adaptability. The pre-test and post-test scores indicate improvement across all categories: Cognitive Adaptability, Behavioral Adaptability, Emotional Adaptability, and Overall Adaptability. The N-gain values for each category fall within the "moderate" range, showing substantial progress. Cognitive Adaptability improved from 41.92 to 48.87, Behavioral Adaptability from 40.35 to 50.21, and Emotional Adaptability from 42.18 to 52.34. Overall Adaptability increased from 41.48 to 50.47, reflecting consistent enhancement in adaptability skills. This indicates that the model effectively supports students in developing adaptability in various dimensions, aligning with the intended learning objectives.

Table 5 presents the homogeneity test results for the community-based social collaborative e-learning model across three adaptability categories: Cognitive, Behavioral, and Emotional Adaptability. For each category, both pre-test and post-test data from 247 participants were analyzed. The mean scores for all categories show a significant increase from pre-test to post-test. Cognitive Adaptability improved from 62.32 to 80.45, Behavioral Adaptability from 68.12 to 83.45, and Emotional Adaptability from 66.34 to 81.12. The standard deviations for all categories remain relatively consistent, indicating that the variability within the data is stable between pre-test and post-test stages. The t-values for all categories are highly negative (-15.96 for Cognitive Adaptability, -16.20 for Behavioral Adaptability, and -15.84

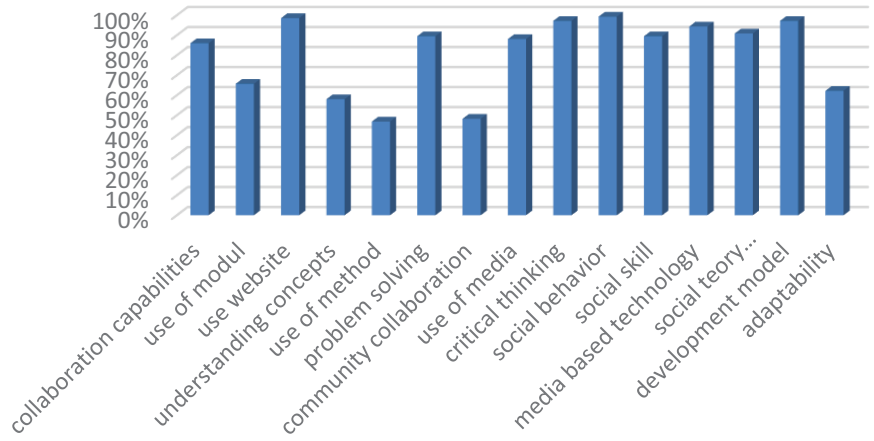


FIGURE 2
Needs analysis for a social collaborative e-learning model based on community participation.

TABLE 4 Results of the analysis of the community-based social collaborative e-learning model.

Category	Pre-test average score	Post-test average score	N-gain	Interpretation
Cognitive adaptability	41.92	48.87	0.41	Moderate
Behavioral adaptability	40.35	50.21	0.50	Moderate
Emotional adaptability	42.18	52.34	0.55	Moderate
Overall adaptability	41.48	50.47	0.49	Moderate

TABLE 5 Homogeneity test of the community-based social collaborative e-learning model.

Assessment item	Stage	Number	Mean	Standard deviation	t-value
Cognitive adaptability	Pre-test	247	62.32	9.99	−15.96
	Post-test		80.45	11.02	
Behavioral adaptability	Pre-test	247	68.12	10.26	−16.20
	Post-test		83.45	11.11	
Emotional adaptability	Pre-test	247	66.34	10.61	−15.84
	Post-test		81.12	11.26	

for Emotional Adaptability), indicating a statistically significant difference between the pre-test and post-test mean scores. This suggests that the intervention significantly influenced students' adaptability in all assessed categories.

The analysis of student responses to the community-based social collaborative e-learning model highlights generally positive perceptions regarding its implementation. Students demonstrated strong agreement and agreement across key aspects of the model, reflecting its relevance and effectiveness in enhancing adaptability within higher education contexts. In terms of cognitive adaptability, students acknowledged the model's ability to support critical analysis of social problems and facilitate the integration of community-based knowledge into learning. They also highlighted its capacity to bridge theoretical concepts with practical applications and underscore the relevance of local culture in e-learning.

As mentioned in Figure 4, this study relied on a qualitative approach, primarily through carefully conducted interviews to get participant responses. The interviews were designed to provide deep insights into educational practices, with participants selected based on their knowledge and experience in the field to ensure the relevance and richness of the data collected. To ensure valid and reliable analysis, the data was systematically interpreted and coded. The coding process involved categorizing discussion findings into thematic clusters that captured similar meanings. This approach helped link the collected data to key concepts, topics, and influencing factors. Consistency in coding was emphasized, as reliable analysis ensures that multiple coders interpret the same text uniformly. The editing process focused on identifying meaningful segments within the text to uncover interpretive truths. A semi-structured question-and-answer approach guided the interviews, using a prepared questionnaire to provide structure

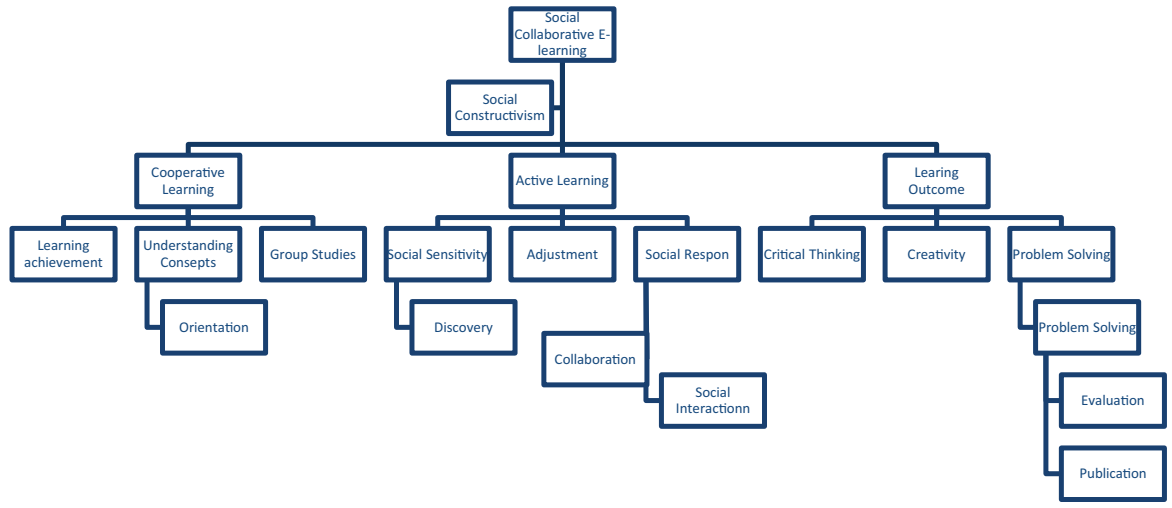


FIGURE 3
Stages of the social collaborative e-learning model based on community participation.

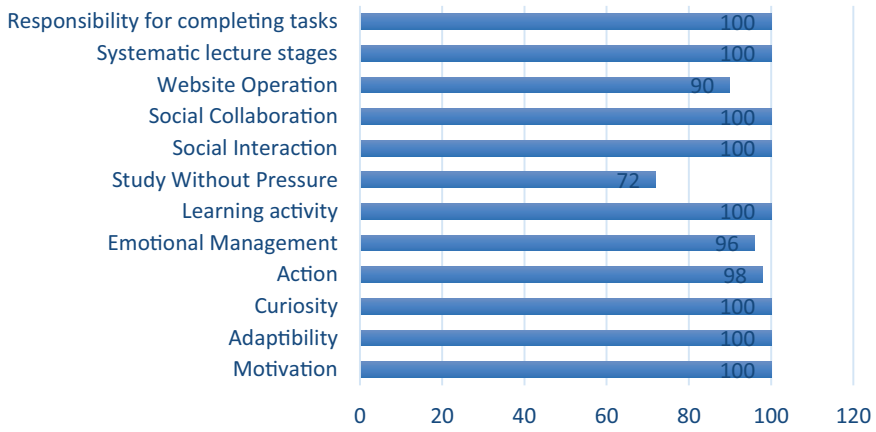


FIGURE 4
Student response.

while allowing flexibility for in-depth exploration (Azman et al., 2012). Additionally, observational methods were employed to complement the interviews, offering a broader understanding of the educational environment and contextual factors influencing practices. These combined methods enhanced the reliability and depth of the research findings.

For behavioral adaptability, the majority of students expressed that the model effectively encouraged flexibility in adapting to group dynamics and active participation in collaborative tasks. Furthermore, students recognized its role in enhancing responsiveness to community-based learning activities and promoting problem-solving based on peer feedback, suggesting its contribution to fostering essential collaborative skills.

Emotional adaptability responses also underscored the model's strengths, particularly in maintaining emotional composure during challenging group scenarios and fostering resilience in overcoming setbacks in social projects. Additionally, the model was perceived as instrumental in building positive relationships and promoting sensitivity to others' emotions and perspectives within team settings. Some of the student responses are provided as follows:

> *"This model helped me see how the concepts we learn in class apply to real-life issues. Collaborating with the local community was eye-opening and made me feel more connected to my surroundings. It's not just about studying but also about making a difference."*

> *"Working on group projects with people from different backgrounds taught me how to adapt and communicate better. I feel more confident now in handling diverse opinions and solving*

> *problems collaboratively, which I think will help me in my future career."*

> *"While I enjoyed the collaborative aspect, sometimes it was frustrating because not everyone contributed equally. It would be better if there was a system to ensure everyone participated fairly, so the workload didn't fall on just a few people."*

Table 6 shows the paired samples test results for the community-based social collaborative e-learning model before and after the intervention. The mean score for the pre-intervention phase is 41.92, while the post-intervention mean increases to 48.87, reflecting improved students' cognitive adaptability following the intervention. The standard deviation for the pre-intervention phase is 3.684. For the post-intervention phase, it is slightly higher at 3.872, indicating that the variability among participants' scores remained consistent but slightly increased after the intervention. The standard error of the mean (SEM) is 0.234 for the pre-intervention phase and 0.246 for the post-intervention phase, suggesting a precise estimate of the population means in both stages. The results indicate that the intervention has a positive effect on the implementation of the model, as evidenced by the notable increase in the mean scores from pre- to post-intervention. It can be concluded that there is a difference in pre-intervention and post-intervention results after being given a social collaborative e-learning model based on local industrial community participation on student adaptability. The results show that there is a significant influence before and after the application of the social collaborative e-learning model based on community participation in the Social Studies course.

The statistical significance of these results confirms the effectiveness of the e-learning model in enhancing adaptability across all measured dimensions. The paired sample *t*-test outcomes validate the model's potential to foster critical competencies required for dynamic and collaborative learning environments. These findings provide strong evidence to support the continued implementation and refinement of the model in higher education settings.

4 Discussion

Based on the results, it shows that there is a significant influence after applying the social collaborative e-learning model based on community participation on the adaptability of students in the Social Studies course. This shows that knowledge can be constructed through activities and learning environments adapted to achieve learning objectives. Developing a community-based social collaborative e-learning model represents a transformative approach to enhancing the adaptability of higher education students in Indonesia. By integrating collaborative learning principles, community participation, and digital technologies, this model addresses the multidimensional aspects of adaptability—cognitive, behavioral, and emotional.

The central advantage of this model lies in its integration of authentic, community-based learning experiences with the flexibility of digital platforms. Collaborative learning theories, particularly Vygotsky's social constructivism, emphasize the importance of interaction and shared problem-solving in building deeper understanding and adaptability. Through direct engagement with local industries and community practitioners, the model contextualizes theoretical knowledge, enabling students to connect abstract concepts with practical applications (Roberts, 2004). For instance, the involvement of local traditional toy-making industries not only enriches the content but also fosters cultural appreciation and social responsibility. Studies by Pereira (2023) on situated learning and Pyrko et al. (2017) concept of communities of practice underscore the significance of such authentic experiences in fostering meaningful learning. These interactions enhance students' ability to adapt to diverse socio-cultural and professional environments, a crucial skill in Indonesia's rapidly evolving educational and economic landscape. The observed outcomes of enhanced collaboration and problem-solving skills directly reflect the integration of these theoretical frameworks into the model. By participating in socially situated and practice-oriented tasks, students developed adaptability in a way that theoretical approaches predict. Explicitly linking these results to communities of practice and situated learning underscores that the model's success lies in its alignment with these foundational theories, which provide a robust framework for understanding and validating the study's findings.

E-learning technology adds another dimension of flexibility and scalability to the model. As Kim and Gurvitch (2020) highlight in their community of inquiry framework, the integration of cognitive, social, and teaching presence in online environments can create a dynamic and engaging learning experience. The model's use of synchronous and asynchronous activities, supported by digital platforms, facilitates continuous interaction and collaboration. This adaptability to time and space constraints makes the model particularly relevant for higher education institutions with geographically dispersed student populations. Moreover, the digital environment enables tracking and assessment of individual and group progress, offering valuable insights for refining the instructional design.

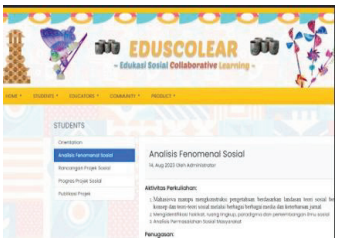
Despite these advantages, the model presents several challenges that must be addressed to maximize its effectiveness. One significant limitation is the reliance on digital infrastructure, which creates disparities in access among students from varying socio-economic backgrounds and regions. Indonesia's digital divide, particularly between urban and rural areas, has been documented in previous studies (Sutrisno et al., 2024; Ariansyah et al., 2019; Onitsuka et al., 2018; Sujarwoto and Tampubolon, 2016). Students in underprivileged regions may face connectivity issues or lack the necessary technological resources, limiting their ability to participate fully in the e-learning components (Ratna Wati et al., 2024; Mulyaningsih et al., 2021). This raises concerns about the inclusivity of the model and the risk of exacerbating existing inequalities. To address this, hybrid learning strategies incorporating offline activities, such as workshops and community-based projects, could provide a more equitable solution.

The implementation of hybrid strategies, as depicted in the Figure 5, integrates both face-to-face and online learning elements, emphasizing collaboration, cultural relevance, and resource adaptability. The model begins with theoretical orientations guided by constructivist, transformative, and social learning theories, focusing on Higher-Order Thinking Skills (HOTS), collaborative engagement, and technology proficiency. Practical

TABLE 6 Paired samples test results.

		Mean	N	Std. deviation	Std. error mean
Pair 1	Pre-intervention	41.92	247	3.684	0.234
	Post-intervention	48.87	247	3.872	0.246


Lecture on children's toys *kitiran, sorongan dan tarikan*



Use of Eduscolear website

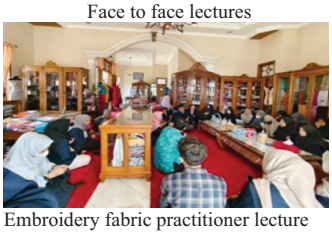
Collaborative project

Collaborative product


Face to face lectures

Practitioner lectures before field work


Practitioner lectures before field work


Embroidery fabric practitioner lecture


Bamboo weaving lectures


Remitan children's game practitioner lecture

FIGURE 5
The implementation of hybrid strategies.

applications, such as field-based learning and collaborative projects, are deeply embedded in the curriculum. Students engage in cultural preservation activities like bamboo weaving and pottery-making, linking academic concepts with real-world applications. The educational platform (Eduscolear[1]) complements this by providing digital resources and coordination tools, enabling blended learning environments that include online and offline components.

In areas with extremely limited resources, this model can be adapted through low-tech or no-tech solutions. Printed materials, community bulletin boards, or radio broadcasts can substitute for digital platforms, ensuring accessibility for theoretical learning. Community spaces or local gathering spots can serve as venues for collaborative activities, leveraging local expertise for the discovery and social interaction stages. Pre-fieldwork preparations can rely on locally available tools, and student-led initiatives can address pressing community needs using Indigenous knowledge and minimal external resources. Communication and coordination can utilize SMS or basic messaging apps to ensure inclusivity, even in digitally underserved regions. This approach ensures the hybrid strategy remains effective and inclusive, fostering educational equity across diverse settings.

Another notable challenge is the model's ability to accommodate diverse learning styles and individual needs. To address these challenges, it is essential to explore adaptations of the model to varied contexts. In resource-limited areas, virtual or simulated communities could be integrated into the model to provide similar collaborative and problem-solving experiences.

Additionally, educators could partner with institutions, local organizations, or even global networks to simulate community interaction, ensuring the model remains relevant and scalable across different educational settings. While collaborative and community-based learning fosters adaptability, it may not fully engage students who prefer independent or highly structured learning environments. Research by Jonathan and Laik (2024) on experiential learning and Chetty et al. (2019) on learning styles emphasizes the importance of catering to varied preferences to maximize learning outcomes. The absence of adaptive mechanisms, such as personalized learning paths or multimodal content delivery, could limit the model's effectiveness for some learners. Addressing this limitation requires incorporating features like AI-driven adaptive learning systems or offering multiple formats of content, such as videos, infographics, and interactive simulations, to ensure broader engagement.

Another important consideration is teacher training. Teachers are pivotal in facilitating and adapting the model to their specific environments. Training programs could focus on equipping educators with the skills to identify and leverage available community resources or create alternative virtual environments for collaboration. These adaptations would enable the model to address contextual variability while maintaining its core principles of fostering adaptability through collaboration.

The sustainability of the model's impact on adaptability is another critical concern. While initial findings may demonstrate significant improvements in students' adaptability, the long-term retention and application of these skills remain uncertain. Research on educational innovations, such as that by Kim and Maloney (2020), highlights the importance of sustained follow-up and iterative refinement to ensure enduring impact. Longitudinal studies are needed to evaluate how well students apply the skills developed through the model in professional or community contexts after graduation. Furthermore, establishing a feedback loop between students, educators, and community stakeholders can provide ongoing insights for improvement and adaptation of the model to changing educational needs.

The involvement of local stakeholders is both a strength and a challenge of the model. On one hand, their participation enriches the learning experience by providing real-world perspectives and resources. Engaging local industry practitioners, such as brings authenticity to the curriculum and fosters stronger ties between academia and society. This approach aligns with Smith et al. (2019) notion of legitimate peripheral participation, where learners engage in authentic community practices to develop their skills. Besides, sustaining this collaboration requires careful planning and coordination. Stakeholders may face competing priorities or resource constraints, which could limit their long-term involvement. Formalizing partnerships through agreements or institutional support can help mitigate these challenges and ensure consistent contributions.

To ensure the continuous improvement and development of the community-based social collaborative e-learning model, a structured approach integrating feedback mechanisms and adaptive strategies is essential (Wagino et al., 2023). Regular student feedback through surveys, focus groups, and journals provides insights for refining activities and tools, while open discussions ensure responsiveness to their needs. Stakeholders, including educators and community leaders, can offer valuable input during scheduled reviews, workshops, and interviews to address challenges and refine the model. Performance metrics, such as adaptability scores and participation rates, help monitor progress, supported by advanced technologies like real-time analytics. Educators' ongoing professional development ensures effective implementation and adaptability, while partnerships with local organizations and government bodies provide essential resources. A cyclical process of planning, feedback, and revision ensures the model remains sustainable, relevant, and impactful for students and stakeholders.

The alignment of this model with Indonesia's Merdeka Belajar Kampus Merdeka (MBKM) initiative underscores its relevance to the nation's educational reform agenda. The MBKM initiative represents a pivotal aspect of Indonesia's educational reform, emphasizing student-centered learning, interdisciplinary approaches, and real-world applications. By aligning with the MBKM framework, the community-based social collaborative e-learning model developed in this study not only addresses the adaptability challenges faced by Indonesian higher education students but also contributes directly to the broader goals of educational transformation (Maqbool et al., 2024), so that ensuring that students are prepared to meet the demands, of both local and global challenges. By emphasizing flexibility, contextual learning, and the integration of local resources, the model supports MBKM's goals of producing adaptable, innovative, and socially responsible graduates. However, its broader implementation requires addressing the scalability of the approach across institutions with varying capacities and regional contexts. Customizable frameworks and flexible implementation guidelines can help adapt the model to diverse institutional needs, ensuring its wider applicability.

5 Conclusion

In conclusion, this research demonstrates the potential of a community-based social collaborative e-learning model to enhance the adaptability of higher education students in Indonesia by integrating local community participation, collaborative learning, and digital tools. The model fosters cognitive, behavioral, and emotional adaptability, aligning with the goals of Indonesia's educational reforms. However, its reliance on digital infrastructure limits accessibility in underserved regions, and the short-term evaluation does not assess long-term sustainability. The findings highlight the importance of inclusive design and stakeholder collaboration, offering implications for curriculum innovation and policy development. Future research should address these limitations and explore broader implementation contexts.

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 humans were approved by University of Muria Kudus University of Muhammadiyah Kudus University of Islam Nahdatul Ulama Jespara. The studies were conducted

in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in this study. Written informed consent was obtained from the individual(s) for the publication of any identifiable images or data included in this article.

Author contributions

IP: Conceptualization, Data curation, Formal Analysis, Investigation, Methodology, Visualization, Writing – original draft, Writing – review and editing. MY: Conceptualization, Investigation, Supervision, Validation, Writing – original draft. Subagya: Data curation, Formal Analysis, Investigation, Methodology, Writing – original draft. SM: Conceptualization, Data curation, Formal Analysis, Investigation, Project administration, Supervision, Writing – original draft, Writing – review and editing. AA: Methodology, Visualization, Writing – original draft, Writing – review and editing.

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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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References

Andriessen, J., Baker, M., and Jarvela, S. (eds) (2013). *Affective Learning Together: Social and Emotional Dimensions of Collaborative Learning*. Milton Park: Routledge. doi: 10.4324/9780203069684

Anoir, L., and Khaldi, M. (2024). "From collaboration to adaptation: designing an adaptive collaborative educational system," in *Innovative Instructional Design Methods and Tools for Improved Teaching*, ed. K. Mohamed (Pennsylvania: IGI Global), 177–195. doi: 10.4018/979-8-3693-3128-6.ch008

Ariansyah, K., Anandhita, V. H., and Sari, D. (2019). "Investigating the next level digital divide in Indonesia," in *Proceedings of the 2019 4th Technology Innovation Management and Engineering Science International Conference (TIMES-iCON)*, (Piscataway, NJ: IEEE), 1–5. doi: 10.1109/TIMES-iCON47539.2019.9024668

Arrasyid, R., Mamat Ruhimat, C. U., Abdullah, A. S., and Darsiharjo, H. R. (2020). Design, development, and evaluation of a mobile learning application for tourism education. *J. Eng. Sci. Technol.* 15, 3859–3875.

Azman, M. N., Ahamad, M. S., Majid, T. A., and Hanafi, M. H. (2012). A qualitative study of precast plants in Malaysia. *Indian Concrete J.* 86, 47–58.

Baharuddin, M. R. (2021). Adaptasi kurikulum merdeka belajar kampus merdeka (Fokus: Model MBKM Program Studi). *J. Studi Guru Dan Pembelajaran* 4, 195–205.

Bullock, R. C., Diduck, A., Luedee, J., and Zurba, M. (2022). Integrating social learning, adaptive capacity and climate adaptation for regional scale analysis: a conceptual framework. *Environ. Manag.* 69, 1217–1230. doi: 10.1007/s00267-022-01630-x

Chang, C.-H., Chen, C.-M., and Zhao, R.-H. (2018). "An effective group incentive mechanism in a collaborative problem-based learning system for enhancing positive peer interaction and learning performance," in *Proceedings of the 7th International Congress on Advanced Applied Informatics*, (IIAI-AAI), 170–175. doi: 10.1109/IIAI-AAI.2018.00041

Chetty, N. D. S., Handayani, L., Sahabudin, N. A., Ali, Z., Hamzah, N., Rahman, N. S. A., et al. (2019). Learning styles and teaching styles determine students' academic performances. *Int. J. Eval. Res. Educ.* 8, 610–615. doi: 10.11591/ijere.v8i3

Cress, U., Stahl, G., Ludvigsen, S., and Law, N. (2015). The core features of CSCL: Social situation, collaborative knowledge processes and their design. *Int. J. Comput. Supported Collaborative Learn.* 10, 109–116. doi: 10.1007/S11412-015-9214-2

Crisp, R. J., and Turner, R. N. (2011). Cognitive adaptation to the experience of social and cultural diversity. *Psychol. Bull.* 137, 242–266. doi: 10.1037/a0021840

Dunbar, R. L., Dingel, M. J., Dame, L. F., Winchip, J., and Petzold, A. M. (2018). Student social self-efficacy, leadership status, and academic performance in collaborative learning environments. *Stud. Higher Educ.* 43, 1507–1523. doi: 10.1080/03075079.2016.1265496

Gall, M. D., Borg, W. R., and Gall, J. P. (1996). *Educational Research: An Introduction*. Harlow: Longman Publishing.

Gedera, D. (2023). A holistic approach to authentic assessment. *Asian J. Assess. Teach. Learn.* 13, 23–34. doi: 10.37134/ajatel.vol13.2.3.2023

Ghavifekr, S. (2020). Collaborative learning: A key to enhance students'social interaction skills. *Malaysian Online J. Educ. Sci.* 8, 9–21.

Hidayat, Z. (2016). Dampak teknologi digital terhadap perubahan konsumsi media masyarakat. *J. Ilmiah Ilmu Komunikasi* 13:59.

Jalinus, N., Verawardina, U., Azis Nabawi, R., and Darma, Y. (2021). Developing blended learning model in vocational education based On 21st century integrated learning and industrial revolution 4.0. *Turk. J. Comput. Math. Educ.* 12, 1239–1254.

Järvelä, S., Kirschner, P. A., Panadero, E., Malmberg, J., Phielix, C., Jaspers, J., et al. (2015). Enhancing socially shared regulation in collaborative learning groups: Designing for CSCL regulation tools. *Educ. Technol. Res. Dev.* 63, 125–142. doi: 10.1007/s11423-014-9358-1

Jonathan, L. Y., and Laik, M. N. (2024). Using experiential learning theory to improve teaching and learning in higher education. *Eur. J. Educ.* 7, 18–33. doi: 10.26417/ejser.v6i1.p123-132

Kim, G. C., and Gurvitch, R. (2020). Online education research adopting the community of inquiry framework: A systematic review. *Quest* 72, 395–409. doi: 10.1080/00336297.2020.1761843

Kim, J., and Maloney, E. J. (2020). *Learning Innovation and the Future of Higher Education*. Baltimore, MA: JHU Press.

Lin, C. Y., and Reigeluth, C. M. (2016). Scaffolding wiki-supported collaborative learning for small-group projects and whole-class collaborative knowledge building. *J. Comput. Assisted Learn.* 32, 529–547. doi: 10.1111/jcal.12140

Maqbool, M. A., Asif, M., Imran, M., Bibi, S., and Almusharraf, N. (2024). Emerging e-learning trends: A study of faculty perceptions and impact of collaborative techniques using fuzzy interface system. *Soc. Sci. Hum. Open* 10:101035. doi: 10.1016/j.ssaho.2024.101035

Martens, H., and Lairamore, C. (2016). The role of student adaptability in interprofessional education. *J. Interprofessional Educ. Pract.* 5, 45–51. doi: 10.1016/j.xjep.2016.10.004

Melissourgos, A., Paraskeva, F., and Mysirlaki, S. (2015). "MMORPGs in the educational Process: Using a CSCL script to assess learning," in *Proceedings of the European Conference on Games Based Learning*, (Academic Conferences International Limited), 793.

Muhammad, I., and Utomo, J. (2024). E-Learning research trends in education in Indonesia. *J. Educ. Glob.* 1, 122–129.

Mulyaningsih, T., Wahyunengseh, R., and Hastjarjo, S. (2021). Poverty and digital divide: A study in urban poor neighborhoods. *J. Ilmu Sos dan Ilmu Polit.* 24, 189–203. doi: 10.22146/jsp.52325

Nesterova, M. (2017). Educational cognitive technologies as human adaptation strategies. *Future Hum. Image* 7, 102–112.

Onitsuka, K., Hidayat, A. R. T., and Huang, W. (2018). Challenges for the next level of digital divide in rural Indonesian communities. *Electronic J. Information Syst. Dev. Countries* 84:e12021. doi: 10.1002/isd2.12021

Pereira, G. (2023). Situated learning, communities of practice and pedagogical innovation. *Científic@-Multidisciplinary J.* 10, 1–6. doi: 10.37951/2358-260X.2023v10i1.6541

Perry, B., and Dockett, S. (2018). Using a bioecological framework to investigate an early childhood mathematics education intervention. *Eur. Early Childh. Educ. Res. J.* 26, 604–617. doi: 10.1080/1350293X.2018.1487161

Pratama, H., Azman, M. N. A., Kassymova, G. K., and Duisenbayeva, S. S. (2020). The trend in using online meeting applications for learning during the period of pandemic COVID-19: A literature review. *J. Innov. Edu. Cult. Res.* 1, 58–68.

Purbasari, I., Yusuf, M., Subagya, Marmoah, S., Fajrie, N., and Mustofa, H. A. (2023). Bamboo woven websites for elementary school students through social collaborative learning approach. *J. Adv. Res. Appl. Sci. Eng. Technol.* 31, 315–325. doi: 10.37934/araset.31.1.315325

Putrawangsa, S., and Hasanah, U. (2018). Integrasi teknologi digital dalam pembelajaran Di Era Industri 4.0. *J. Tatsqif* 16, 42–54. doi: 10.20414/jtq.v16i1.203

Pyrko, I., Dörfler, V., and Eden, C. (2017). Thinking together: What makes communities of practice work? *Hum. Relat.* 70, 389–409. doi: 10.1177/0018726716661040

Ratna Wati, D. A., Čaplánová, A., and Darmo, Ľ. (2024). Identification of digital divide across Indonesian Provinces: the analysis of key factors. *Statistika Stat. Econ. J.* 104, 185–198. doi: 10.54694/stat.2024.3

Roberts, T. S. (2004). *Online Collaborative Learning: Theory and Practice*. Pennsylvania: IGI Global.

Sirotiak, T., and Sharma, A. (2019). Problem-based learning for adaptability and management skills. *J. Professional Issues Eng. Educ. Pract.* 145, 1–6. doi: 10.1061/(ASCE)EI.1943-5541.0000420

Smith, D. A., Fox, E. C., and Jordan, A. T. (2019). "Engaging industry stakeholders," in *Stakeholder Engagement: Improving Education through Multi-Level Community Relations*, eds H. Tran, D. A. Smith, and D. G. Buckman (Lanham, MA: Rowman & Littlefield), 149–164.

Sotto, R. J. B. (2021). Collaborative learning in the 21st century teaching and learning landscape: Effects to students' cognitive, affective and psychomotor dimensions. *Int. J. Educ. Manag. Innov.* 2:136. doi: 10.12928/ijemi.v2i2.3325

Stockinger, K., Rinas, R., and Daumiller, M. (2021). Student adaptability, emotions, and achievement: Navigating new academic terrains in a global crisis. *Learn. Individ. Diff.* 90:102046. doi: 10.1016/j.lindif.2021.102046

Sujarwoto, S., and Tampubolon, G. (2016). Spatial inequality and the Internet divide in Indonesia 2010–2012. *Telecommun. Policy* 40, 602–616. doi: 10.1016/j.telpol.2015.08.008

Sutrisno, E., Silitonga, M. S., Yusuf, R. R., and Nugroho, A. A. (2024). Digital divide: How is Indonesian public service affected? *JPPI (Jurnal Penelitian Pendidikan Indonesia)* 10, 454–463. doi: 10.29210/020244613

Vega, N., Stanfield, J., and Mitra, S. (2020). Investigating the impact of computer supported collaborative learning (CSCL) to help improve reading comprehension in low performing urban elementary schools. *Educ. Information Technol.* 25, 1571–1584. doi: 10.1007/s10639-019-10023-3

Wagino, W., Maksum, H., Purwanto, W., Krismadinata, K., Suhendar, S., and Koto, R. D. (2023). Exploring the full potential of collaborative learning and E-learning environments in universities: A systematic review. *TEM J.* 12, 1772–1785.

Zhang, Y., Leung, S. K. Y., and Li, H. (2021). Parental play beliefs in the developing areas of china: A multiple case study. *Educ. Sci.* 11:625. doi: 10.3390/educsci11100625