

# Challenges and Opportunities of Cooperative Learning in Synchronous Distance Education among Adolescent and Young Adult Learners

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**Abstract**—With the evolution of distance and hybrid education in recent years, synchronous distance education has gained prominence as a mode of instruction. Recent studies have highlighted the challenges of student engagement in synchronous distance courses and the associated risks of academic disengagement. Consequently, addressing these concerns has become a primary focus within educational research. This paper uses the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) method to investigate the impact of cooperative learning methods within synchronous distance education. Our objective was to provide insights into the current state of knowledge, identify gaps in the literature, and offer directions for future research and practice. We also look at the complexities of student engagement and retention in the context of synchronous distance learning, while exploring the potential of cooperative learning strategies to mitigate these challenges. Thanks to its examination of relevant studies, this review contributes to our understanding of effective pedagogical approaches in synchronous distance education from high school through to university, and provides valuable insights for educators and researchers striving to enhance student engagement and academic success in online learning environments.

**Keywords**—synchronous distance education, cooperative learning, student engagement, online learning environments

## I. INTRODUCTION

The landscape of education has undergone significant transformation in recent years, propelled by advancements in technology and the evolving needs of learners. Particularly noteworthy is the proliferation of distance and hybrid education modalities, which have become increasingly prevalent, especially in response to global events such as the COVID-19 pandemic [1]. Asynchronous distance education, characterized by flexibility in time and space, has garnered considerable attention in educational research and practice [2]. However, synchronous distance education, where learners engage in real-time interaction with instructors and peers, has

received comparatively less scrutiny despite its growing importance in contemporary educational settings.

Recent studies have underscored the challenges associated with synchronous distance education, notably concerning student engagement and retention [3–5]. The shift from traditional face-to-face instruction to virtual classrooms has raised concerns about the effectiveness of pedagogical approaches and the risk of academic disengagement among students [6]. While various strategies have been proposed to address these challenges, such as increased interactivity and multimedia integration, there remains a notable gap in the literature regarding the efficacy of cooperative learning methods within synchronous distance education among adolescent and young adult learners.

The significance of addressing this gap lies in the potential to enhance student engagement, collaboration, and learning outcomes in synchronous distance learning environments [7]. Cooperative learning, characterized by collaborative interactions among students working towards shared learning goals, holds promise as a pedagogical approach to foster meaningful engagement and mitigate the risks of academic disengagement [8]. By leveraging cooperative learning strategies within synchronous distance education, educators can create inclusive and dynamic learning environments conducive to active participation and knowledge construction [9]. Social presence, defined as the degree to which individuals perceive the presence of others and feel a sense of belonging, is a crucial element in cooperative learning environments [10]. In the context of online learning, including synchronous distance education, assessing and fostering social presence presents a significant challenge. Understanding the current methods used to measure social presence in diverse online learning environments is essential for enhancing collaborative learning experiences and improving educational outcomes [11].

Early exploratory studies [12, 13] focused on unraveling how social presence is measured in various online learning environments, such as e-learning, video-based learning, Computer-Supported Collaborative Learning (CSCL), and synchronous courses. These studies identified and

analyzed relevant social presence indicators, considering the unique characteristics and dynamics of each learning context [14, 15].

This paper provides a systematic literature review using the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) method [16]. Through a comprehensive examination of existing research, this literature review seeks to elucidate the limitations and opportunities of cooperative learning in synchronous distance education. It critically examines existing approaches to measuring social presence in online learning environments and assesses the suitability of different indicators across diverse learning contexts.

By giving an insight into effective pedagogical practices and identifying areas for further inquiry, this review aims to provide educational stakeholders with relevant information that may stimulate the ongoing discourse on optimizing online learning experiences in synchronous distance education settings.

## II. METHODOLOGY

The articles were collected as part of a broader project that is focused on the literature relating to cooperative learning in synchronous distance education among adolescent and young adult learners (Lestrade, Lima, and Pansu, in progress). These articles have been partially used here to give an overview of the challenges and opportunities of cooperative learning in this context, which will be explored in depth in the afore-mentioned project.

The systematic review adhered to the PRISMA guidelines to ensure rigor and transparency in the review process [16]. PRISMA provides a standardized approach for conducting systematic reviews and meta-analyses, promoting consistency and replicability across studies. A review protocol was developed to outline the methodological framework that contains the following four components:

- (1) **Search Strategy:** A search strategy was devised to identify relevant studies from three databases (ERIC, Science Direct, and Google Scholar). The strategy included keywords and Boolean operators tailored to each database to maximize the retrieval of relevant literature.
- (2) **Eligibility Criteria:** Criteria for inclusion and exclusion of studies were established to ensure the relevance and quality of the selected literature. Studies were included if they addressed the measurement of social presence in online learning environments, specifically focusing on synchronous distance education. Only peer-reviewed articles published in English were considered eligible for inclusion.
- (3) **Data Extraction:** A standardized data extraction form was developed to systematically extract relevant information from the selected studies. Data extraction included details such as author(s), publication year, research objectives, methodology, key findings, and measurement tools used to assess social presence.

- (4) **Data Synthesis:** A synthesis of the extracted data was conducted to identify common themes, trends, and patterns across the selected studies. Qualitative analysis techniques, such as thematic analysis, were employed to derive meaningful insights from the synthesized data.

By following these methodological steps in accordance with the PRISMA guidelines, this systematic review aimed to provide an analysis of the existing literature on the measurement of social presence in synchronous distance education.

### A. Research Questions

Based on an analysis of previous studies and the identified gaps in the literature, the review questions for this study were formulated to address the following areas:

- **Examination of Cooperative Learning (CL) design in Synchronous Distance Education (SDE):** to investigate the existing literature on CL design within the context of SDE.
- **Evaluation of CL models used in SDE:** the review aimed to assess the utilization of CL models in SDE settings to identify the coverage of CL models in the existing literature on SDE.
- **Identification of variables:** the study aimed to identify and measure the variables that influence the effectiveness of CL design in SDE. Understanding these variables is essential for optimizing CL practices and enhancing learning outcomes in synchronous distance education environments.

Therefore, this literature review seeks to address the following research questions:

RQ1: What are the current trends and challenges in the design and implementation of cooperative learning models in synchronous distance education, and how do these models contribute to fostering social, teaching, and cognitive presence among learners?

RQ2: What are the existing methodologies and instruments used to measure social presence in synchronous distance education settings?

RQ3: What are the identified factors and variables that influence the effectiveness of cooperative learning design in synchronous distance education, and how do these factors impact student engagement, collaboration, and learning outcomes in online learning environments?

### B. Study Selection

To identify all relevant studies, we searched several online databases: ERIC, Science Direct, and Google Scholar. Specific search strings were utilized to identify relevant articles, including “Cooperative learning”, “Distance education”, “Online courses”, “Social Presence” and “Synchronous communication”.

During the search process of articles, Boolean operators (AND, OR) were employed to combine the search terms and refine the search results. The titles and abstracts of the retrieved articles were reviewed to assess their relevance to the research questions. Duplicate entries were removed within each database to ensure the integrity of the dataset.

At first, 1036 documents have been found and 137 have been sorted after removal of duplicates.

Overall, the search yielded a total of 899 articles across the selected databases. These articles underwent further screening and evaluation to address the research questions listed above.

C. Inclusion and Exclusion Criteria

As depicted in Table I, a predefined set of inclusion and exclusion criteria was applied to ensure the selection of pertinent studies and maintain the focus of the review. Subsequently, the screening of titles and abstracts led to the exclusion of 790 papers out of a total of 899. The remaining 109 papers underwent eligibility assessment, of which 80 failed to meet the predefined inclusion and exclusion criteria. Consequently, 29 research studies were deemed suitable for inclusion in this systematic review. An outline of the study selection process, following the PRISMA guidelines, is illustrated in Fig. 1.

TABLE I. INCLUSION AND EXCLUSION CRITERIA

Inclusion	Exclusion
SDE as the main focus of the research	SDE not as the main focus of the research (blended learning, hybrid learning, asynchronous learning)
School population	Other population (Online customer service, corporate training)
CL as a mode in SDE	CL as a mode but not in SDE
Available as a full text	Not available as a full text

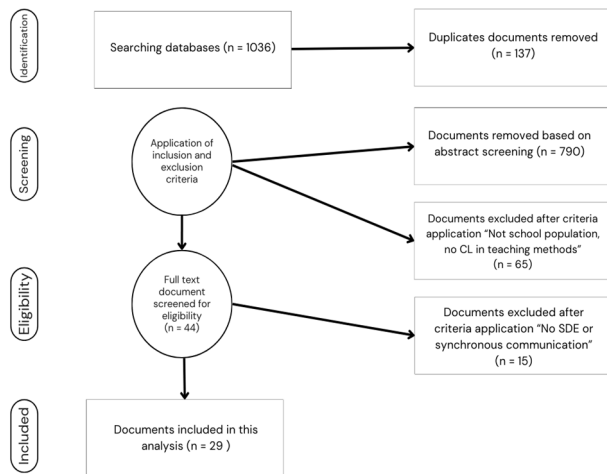


Fig. 1. PRISMA flowchart.

III. RESULTS

TABLE II. FOCUS OF THE SELECTED DOCUMENTS IN RESPONSE TO THE RESEARCH QUESTIONS

Articles	Quantity	Focus
18, 19, 20, 25, 26, 28, 31, 32, 33, 35, 38, 39, 41, 42	14	Teaching and engagement strategies in SDE
17, 11, 18, 25, 26, 34, 35, 36, 38, 39, 42, 44	12	Social, cognitive and teaching presence in distance education
20, 21, 22, 23, 24, 27, 29, 30, 32, 33, 37, 38, 40, 43	14	Use of CL in learning online environments

Table II presents the three key themes in the selected documents [11, 17–44]: teaching and engagement strategies in SDE, methods for measuring social, cognitive, and teaching presence in distance education, and the utilization of CL in online learning environments.

14 documents that shed light on various teaching and engagement strategies employed in SDE were identified. These documents offer insights into effective pedagogical approaches for facilitating learning in synchronous online environments, addressing challenges related to student engagement, interaction, and retention.

Among the selected documents, 12 focus on different methodologies and instruments used to assess social, cognitive, and teaching presence in distance education. These documents contribute to the understanding of how educators can effectively measure and evaluate the quality of online learning experiences, emphasizing the importance of fostering a supportive and interactive virtual learning environment.

A total of 14 documents highlight the utilization of Cooperative Learning (CL) in online learning environments. These documents explore the implementation of CL strategies to promote collaborative learning experiences, foster peer interaction, and enhance knowledge construction in virtual classrooms. They underscore the significance of collaborative teaching methods in facilitating meaningful learning outcomes in online educational settings.

A. Teaching and Engagement Strategies in SDE

In the realm of Synchronous Distance Education (SDE), effective teaching and engagement strategies play a pivotal role in fostering meaningful learning experiences and promoting student success. This section brings together findings from a selection of research studies focusing on diverse approaches to teaching and engaging students in synchronous virtual classrooms. Different studies explore the integration of the Community of Inquiry (CoI) framework to transform online learning designs from content-centric to collaborative experiences (Fig. 2) [17, 42]. By prioritizing critical reflection and professional discourse within online learning communities, the CoI framework offers a pathway to enriching lifelong learning practices. Student perceptions and recommendations inform insights into refining online course designs based on the CoI model [18].

Furthermore, investigations into traditional versus cooperative online teaching approaches shed light on effective instructional practices in SDE. For instance, a study comparing Cooperative Learning (CL) with traditional methods in community college settings reveals the superiority of CL in promoting student engagement and learning outcomes [11]. Notably, the examination of online instructional design courses underscores the importance of designing collaborative learning experiences that prioritize student interaction, critical reflection, and community building. By aligning course design with the principles of the CoI framework, instructors can create environments conducive to active participation, knowledge construction, and peer support in virtual learning communities.

Another study delves into the teaching of 21st century skills, such as communication, collaboration, critical thinking, and creativity, within synchronous virtual classrooms [19]. By identifying digital resources that integrate content learning with the development of these skills, the study [28] highlights the potential of synchronous virtual classrooms to offer unique advantages in preparing students to cooperate and be engaged in their school program. Another study examines student attitudes and the effectiveness of various teaching and management strategies [35]. This research sheds light on the integration of technology and pedagogical methods in online courses, aiming to identify effective instructional strategies for building collaborative learning situations in synchronous virtual settings [21, 22].

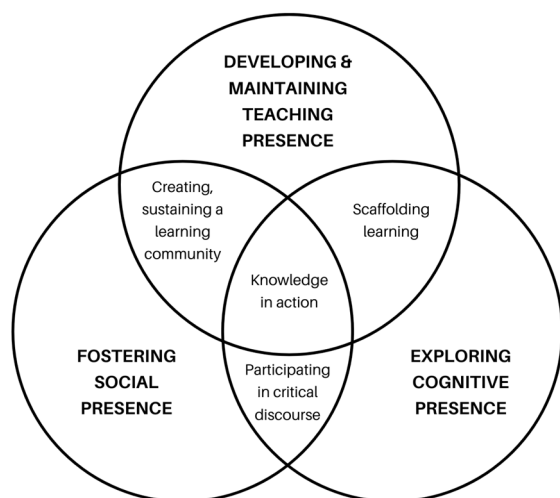


Fig. 2. CoI framework.

In response to the unprecedented shift to emergency online learning, different studies investigate engagement strategies perceived as effective by higher education students, particularly in low-resource settings [25, 31]. Through a mixed-methods approach, the study [27] identifies student-content, student-teacher, and student-student engagement strategies, offering valuable insights for instructors, instructional designers, and researchers navigating emergency online learning environments.

An examination of the effects of remote learning on student engagement and perceived success in undergraduate science courses provides insights from both student and instructor perspectives. By identifying challenges and effective strategies for remote course delivery, the study [29] contributes to ongoing efforts to enhance student engagement and learning outcomes in virtual classrooms. Social media or collaborative platforms can enhance social presence and foster collaboration in synchronous distance education. Integration of microblogging tools aligns with the principles of cooperative learning, promoting active participation and knowledge sharing among students. Research on traditional versus cooperative online teaching provides insights into effective instructional practices, offering guidance for instructors seeking to implement collaborative learning strategies in SDE [42].

However, in examining the landscape of cooperative learning in SDE, it becomes evident that most studies have relied on indirect measures to assess the impact of teaching strategies and interactions. These indirect measures often include the analysis of discussion group usage or the administration of satisfaction surveys to both students and instructors [11]. While these methods offer valuable insights into the perceptions and experiences of participants, they may not provide a comprehensive understanding of the actual impact of teaching strategies and interactions on learning outcomes. One of the primary limitations of relying solely on indirect measures is the lack of real-time assessment of teaching strategies and interactions. Without direct observation or measurement of these components, researchers may miss crucial factors that shape the learning experience in SDE. For example, while a satisfaction survey can indicate overall student satisfaction with cooperative learning activities, it cannot capture the specific moments of engagement or frustration that students may experience during synchronous sessions.

Furthermore, self-reported measures may be subject to response bias, where participants provide socially desirable responses rather than reflecting their true experiences. This bias can lead to inaccurate conclusions about the impact of teaching strategies on learning outcomes. Reliance on self-report data alone may overlook important contextual factors that influence student engagement and learning in SDE [28].

To address these limitations, future research in cooperative learning in SDE should consider incorporating more direct measures of teaching strategies and interactions. One approach could involve real-time observation or analysis of synchronous teaching sessions using video recordings or screen capture technology. By systematically documenting teaching strategies, student interactions, and learning outcomes as they unfold, researchers can gain a more nuanced understanding of the dynamics at play in SDE environments [30]. Researchers could explore the use of learning analytics tools to track student engagement and participation during synchronous sessions. These tools can provide quantitative data on factors such as frequency of contributions, depth of engagement, and patterns of interaction, offering valuable insights into the effectiveness of cooperative learning strategies in promoting active learning and knowledge construction. In addition to direct observation and measurement, researchers could also consider implementing experimental designs to evaluate the causal relationship between teaching strategies, interactions, and learning outcomes in SDE. By randomly assigning participants to different instructional conditions and systematically manipulating variables of interest, researchers can establish stronger causal inferences about the effectiveness of cooperative learning approaches in SDE.

Overall, while self-reported measures have proven useful [44], incorporating more observable behavioral measures is essential for advancing our understanding of the mechanisms underlying effective teaching and learning in online environments.

### B. Social, Cognitive and Teaching Presence in Distance Education

Different studies investigating Collaborative Synchronous Learning Environments (CSLE) within the framework of the CoI model shed light on the effectiveness of such learning approaches in online education [17, 18, 42]. The CoI model, comprising three presences – social, cognitive, and teaching – serves as a theoretical lens through which we may examine the dynamics of online learning environments and interactions among students and instructors (Fig. 3).

Social presence, the ability of students to represent themselves authentically in an online community, is crucial to fostering a sense of belonging and engagement in virtual learning spaces. Cognitive presence, on the other hand, involves the process of conceptualizing problems, engaging in meaningful discourse with peers to explore knowledge, constructing meaning from acquired information, and collectively solving problems to reach a consensus [38]. Teaching presence encompasses the design, facilitation, and guidance of cognitive and social activities to achieve meaningful learning outcomes.

Several research designs have been used to assess students' perceptions of the CoI elements and interaction levels within CSLE [34]. They compare the perceptions of students in experimental and control groups regarding the effectiveness of CSLE in promoting collaborative learning and enhancing learning outcomes. The results show that the experimental groups (CSLE) exhibit significantly higher perception scores compared to the control groups [21, 32]. This finding suggests that CSLE, characterized by student-centered instruction and active engagement in socio-cognitive communication, offers a more effective learning experience than traditional teacher-centered approaches in online synchronous settings [11].

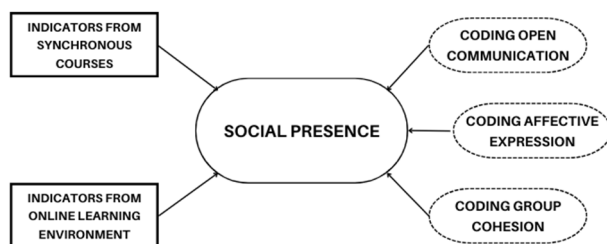


Fig. 3. Measure of social presence in online learning environments.

Collaborative learning approaches have been shown to facilitate knowledge construction, problem-solving skills, and individual learning performance in online environments. Previous research has highlighted the benefits of collaborative learning in promoting deeper understanding, critical thinking, and peer interaction [27, 36]. The positive effect observed in these studies reinforces the importance of fostering collaborative learning environments in online education. The findings underscore the value of integrating collaborative synchronous learning activities that promote social interaction, cognitive engagement, and effective teaching strategies. By leveraging technology to facilitate meaningful peer interactions and collaborative problem-

solving tasks, educators can create rich learning experiences that enhance student engagement and foster stronger learning outcomes [39]. Further research is needed to explore the specific mechanisms through which collaborative synchronous learning environments impact student perceptions, engagement, and learning outcomes.

This empirical investigation delves into the dynamics of online learning environments, particularly in synchronous settings, where instructors collaborate remotely to facilitate learning experiences [38, 43]. The primary objective of these studies is to understand how social interactions among instructors contribute to the development of both social and cognitive dimensions of engagement [17]. In the online learning environment, social presence refers to the ability of instructors to establish a sense of community. Cognitive presence involves the cognitive processes of learners, such as problem-solving, critical thinking, and knowledge construction, facilitated through interaction and discourse [30]. Empirical studies in this domain often use qualitative and quantitative methods to assess the impact of social interactions. Questionnaires are commonly used to gather data on participants' perceptions of social presence, cognitive engagement, and overall learning experiences [40]. However, there are limitations to relying solely on self-reported data.

One of the key limitations of existing research is the lack of direct measures of learner engagement and social presence. While questionnaires give information about participants' perceptions, they do not provide factual information about the interactions and engagement in the virtual classroom [45]. Without observed behavioral measures, researchers may overlook important nuances in the sociocognitive dynamics of online learning. Furthermore, the reliance on self-reported measures may introduce bias and inaccuracies in data interpretation [46]. Participants' responses to questionnaires may be influenced by social desirability bias or subjective interpretations of their experiences. As a result, the validity and reliability of findings may be compromised, limiting the generalizability of research findings. To address these limitations, future studies could incorporate more objective measures of learner engagement and social presence, such as observational techniques, interaction analysis, and content analysis of online discourse. By observing and analyzing learner behaviors and interactions, researchers can learn more about the sociocognitive processes underlying online learning. In addition, mixed-method approaches that combine qualitative and quantitative data collection methods can provide a better understanding of social presence in distance education. By triangulating multiple sources of data, researchers can corroborate findings and better understand the complex interplay between social interactions, cognitive engagement, and learning outcomes. Overall, while existing research on social presence in distance education has provided valuable insights into the role of social interactions in online learning, there is a need for further investigation using more rigorous methodological approaches [15].

### *C. Use of CL in Learning in Online Environments*

The findings from various studies exploring cooperative learning in synchronous distance education reveal several limitations that educators need to address [22, 23, 35, 40]. One significant challenge is the difficulty in coordinating group activities in a synchronous distance teaching environment. This challenge arises due to technical and communication issues, which can hinder the smooth functioning of collaborative tasks. For instance, unreliable internet connections or technical glitches may disrupt real-time interactions among group members, impacting the overall effectiveness of cooperative learning experiences.

Moreover, ensuring fair evaluation of individual participation poses another obstacle in synchronous distance education because traditional assessment methods may not adequately capture the varied levels of input from each student, leading to grading disparities [34]. As a result, educators must devise equitable evaluation strategies that accurately reflect students' collaborative efforts in virtual group settings.

Additionally, there is the paradox of social isolation in cooperative learning environments. While cooperative learning aims to foster social interaction, some students may experience feelings of isolation, particularly when working remotely [6]. This sense of isolation may arise if students struggle to establish meaningful connections with their peers during remote cooperative learning tasks. Factors such as limited opportunities for face-to-face interaction, difficulty in building rapport with classmates virtually, or feelings of disconnectedness from the learning community can contribute to this phenomenon [26]. Addressing these limitations requires a multifaceted approach that incorporates pedagogical, technological, and social interventions. Educators can implement strategies to mitigate the challenges of coordinating group activities in synchronous distance education by providing clear instructions, leveraging user-friendly collaborative tools, and fostering a supportive online learning environment. Adopting alternative assessment methods, such as peer evaluation or self-assessment, can promote transparency and fairness in evaluating group work [29].

To tackle social isolation, educators should prioritize building a sense of community and belonging. This can be achieved through interactive icebreaker activities, facilitating virtual team-building exercises, and encouraging regular peer interactions [15]. Creating opportunities for students to engage in informal discussions, virtual social events, or online group projects can enhance social connectedness and mitigate feelings of isolation.

Furthermore, investing in technological infrastructure and digital literacy training can help alleviate the technical challenges associated with synchronous distance education. Providing technical support resources, offering training sessions on using collaborative software platforms effectively, and ensuring reliable internet connectivity can enhance the overall learning experience and minimize disruptions [39]. While cooperative learning holds promise for enhancing student engagement and learning outcomes in synchronous distance education, teachers

must navigate various challenges to ensure its successful implementation. By addressing issues such as coordination difficulties, equitable assessment practices, and social isolation, educators should be able to create more inclusive and effective cooperative learning environments in virtual settings.

## IV. DISCUSSION

Based on the CoI model, our analysis of the literature may assist teachers in designing, developing, and implementing collaborative educational experiences [47]. This model offers a structured approach to facilitate collaborative learning, supporting the generation of knowledge through interdisciplinary online learning activities [48]. By using this model as a basic framework, educators can foster a more productive environment for both learners and instructors, that enhances social interaction, instructional facilitation, and cognitive engagement, thereby enriching the overall learning experience. The recommendation for conducting in-depth research to objectively measure student engagement in synchronous distance education environments and assess its impact compared to traditional distance learning environments requires rigorous evaluation of online teaching methods [49, 50].

Furthermore, investigating cooperative learning strategies tailored specifically for distance education settings is essential for promoting student interaction and engagement. By examining the effectiveness of various cooperative learning models and techniques in synchronous and asynchronous online environments, researchers can identify best practices in the virtual classrooms.

Innovative approaches to monitor online teaching practices are needed in view of the lack of real-time measurement tools for assessing social presence in synchronous distance education [50]. While some attempts have been made to develop machine learning-based coding methods to analyze social presence in virtual classrooms, the absence of a standardized methodology remains a significant challenge [51].

The study [19] measures student engagement in traditional teaching settings using facial expression analysis with Action Units (AU). By monitoring micro-expressions and subtle changes in students' facial expressions, researchers can learn about their levels of attention, interest, and engagement. Facial expression analysis provides quantifiable data on student engagement by measuring variations in Action Units and associating them with specific levels of cognitive and affective engagement. Facial expression analysis can be conducted in a non-intrusive manner that enables continuous data collection without disrupting the class.

## V. CONCLUSION

This systematic review of the literature reflects the challenges and opportunities of cooperative learning in synchronous distance education. Its examination of various studies reveals a multifaceted landscape

characterized by both limitations and prospects in leveraging cooperative learning strategies in online settings.

One of the primary challenges highlighted is the difficulty in assessing student engagement and social presence effectively. While some studies have attempted to measure these aspects through questionnaires and qualitative analysis, there remains a need for more objective and real-time assessment methods [47]. The exploration of innovative tools, such as facial expression analysis, holds promise in providing deeper insights into student engagement levels during synchronous distance learning sessions.

The review underscores the importance of addressing technical and communication challenges inherent in synchronous online environments [14]. Issues related to coordination of group tasks, equitable evaluation of participation, and social isolation pose significant hurdles that need to be overcome. To mitigate these challenges and create a conducive learning environment, efforts to enhance digital literacy and foster a supportive online community should be made. In addition, cooperative learning presents several opportunities in synchronous distance education. Studies have shown that cooperative learning improves social and cognitive presence among students, thereby enhancing their overall synchronous distance learning experience [33].

Looking ahead, there is a clear need for further research to advance our understanding of cooperative learning in synchronous distance education. Future studies should focus on developing objective measures of student engagement, exploring the effectiveness of different cooperative learning strategies, and investigating ways to overcome technical and communication barriers. While cooperative learning in synchronous distance education presents its share of challenges, it also offers promising opportunities for enhancing student engagement and learning outcomes.

#### CONFLICT OF INTEREST

The authors declare no conflict of interest.

#### AUTHOR CONTRIBUTIONS

Kevin Lestrade, Laurent Lima, and Pascal Pansu conducted the research, analyzed the data, and gave guidance on the conceptual research; the selection of articles was made by Kevin Lestrade and approved by all; Kevin Lestrade wrote the first version, which was revised by Laurent Lima and Pascal Pansu; all authors had approved the final version.

#### REFERENCES

- [1] M. Charytanowicz, "Online education vs traditional education: Analysis of student performance in computer science using Shapley additive explanations," *Informatics in Education*, vol. 22, no. 3, pp. 351–368, 2023.
- [2] J. B. Fabula, "Hybrid learning experiences of college students with special education needs," *LAFOR Journal of Education*, vol. 11, no. 3, pp. 29–49, 2023.
- [3] L. A. Lopes, "Creative challenge to stimulate student engagement in natural science education in distance learning," *Pedagogical Research*, vol. 9, no. 1, 2024. <https://eric.ed.gov/?id=EJ1415762>
- [4] C. Riegel and A. Kozen, "Attaining 21st century skills in a virtual classroom," *Educational Planning*, vol. 23, no. 3, pp. 41–55, 2016.
- [5] K. A. Schreder, J. Alonzo, and H. McClure, "Building an inclusive pedagogy in synchronous online learning environments focused on social justice issues: A case study," *International Journal of Technology in Education*, vol. 6, no. 1, pp. 1–18, 2023.
- [6] T. J. Zorkic, K. Micic, and T. K. Cerovic, "Lost trust? The experiences of teachers and students during schooling disrupted by the COVID-19 pandemic," *Center for Educational Policy Studies Journal*, vol. 11, pp. 195–218, 2021.
- [7] W. Daher, A. Anabousy, and E. Alfahel, "Elementary teachers' development in using technological tools to engage students in online learning," *European Journal of Educational Research*, vol. 11, no. 2, pp. 1183–1195, 2022.
- [8] C. Sugino, "Student perceptions of a synchronous online cooperative learning course in a Japanese women's university during the COVID-19 pandemic," *Education Sciences*, vol. 11, 2021. <https://eric.ed.gov/?id=EJ1297076>
- [9] M. A. A. Sulaiman and V. S. Thakur, "Effects of cooperative learning on cognitive engagement and task achievement: A study of Omani bachelor of education program EFL students," *Arab World English Journal*, vol. 13, no. 1, pp. 38–55, 2022.
- [10] C. Bosch and D. J. Laubscher, "Cooperative learning as a strategy for self-directed learning in blended-distance learning environments: A systematic literature review," *Student Support Toward Self-Directed Learning in Open and Distributed Environments*, 2019.
- [11] L. Kupczynski, M.-A. Mundy, and A. Ruiz, "A comparison of traditional and cooperative learning methods in online learning," *Journal of Educational Technology*, vol. 10, no. 2, pp. 21–28, 2013.
- [12] M. Akcaoglu and M. O. Akcaoglu, "Understanding the relationship among self-efficacy, utility value, and the community of inquiry framework in preservice teacher education," *International Review of Research in Open and Distributed Learning*, vol. 23, no. 2, pp. 86–106, 2022.
- [13] G. Stankovska, D. Dimitrovski, Z. Ibraimi, and I. Memedi, "Online learning, social presence and satisfaction among university students during the COVID-19 pandemic," *Bulgarian Comparative Education Society*, 2021. <https://eric.ed.gov/?id=ED613967>
- [14] Y. Cai, Z. Pan, S. Han, P. Shao, and M. Liu, "The impact of multimodal communication on learners' experience in a synchronous online environment: A mixed-methods study," *Online Learning*, vol. 26, no. 4, pp. 118–145, 2022.
- [15] S. A. Aslan and Y. E. Turgut, "Effectiveness of community of inquiry based online course: cognitive, social and teaching presence," *Journal of Pedagogical Research*, vol. 5, no. 3, pp. 187–197, 2021.
- [16] M. J. Page, *et al.*, "The PRISMA 2020 statement: an updated guideline for reporting systematic reviews," *BMJ*, vol. 372, p. n71, 2021, doi: 10.1136/bmj.n71
- [17] O. Solmaz, "Beyond140: Helping pre-service teachers construct a community of inquiry on Twitter," *Turkish Online Journal of Educational Technology – TOJET*, vol. 15, no. 4, pp. 1–15, 2016.
- [18] K. Krzyszkowska and M. Mavrommati, "Applying the community of inquiry e-learning model to improve the learning design of an online course for in-service teachers in Norway," *Electronic Journal of e-Learning*, vol. 18, no. 6, pp. 462–475, 2020.
- [19] M. A. A. Dewan, M. Murshed, and F. Lin, "Engagement detection in online learning: A review," *Smart Learning Environments*, vol. 6, no. 1, p. 1, 2019. doi: 10.1186/s40561-018-0080-z
- [20] H.-Y. Ku, L. Lohr, and Y.-C. Cheng, "Collaborative learning experiences in online instructional design courses," *Association for Educational Communications and Technology*, 2004. <https://eric.ed.gov/?id=ED485070>
- [21] L. Kupczynski, M. A. Mundy, J. Goswami, and V. Meling, "Cooperative learning in distance learning: A mixed methods study," *International Journal of Instruction*, vol. 5, no. 2, 2012. <https://eric.ed.gov/?id=ED533785>
- [22] M. Paulsen, "Cooperative online education," *Seminar.net*, vol. 4, 2008. doi: 10.7577/seminar.2482
- [23] J. E. Brindley, C. Walti, and L. M. Blaschke, "Creating effective collaborative learning groups in an online environment,"

- International Review of Research in Open and Distance Learning*, vol. 10, no. 3, 2009. <https://eric.ed.gov/?id=EJ847776>
- [24] R. Ekblaw, "Effective use of group projects in online learning," *Contemporary Issues in Education Research*, vol. 9, no. 3, pp. 121–128, 2016.
- [25] V. Abou-Khalil, S. Helou, E. Khalifé, M. A. Chen, R. Majumdar, and H. Ogata, "Emergency online learning in low-resource settings: Effective student engagement strategies," *Education Sciences*, vol. 11, 2021. <https://eric.ed.gov/?id=EJ1283091>
- [26] S. Kispert and C. Gross, "Engagement in the undergraduate science course: Lessons learned about participation and distraction from the remote classroom," *HAPS Educator*, vol. 27, no. 1, pp. 16–25, 2023. <https://www.ijlter.org/index.php/ijlter/article/view/4342>
- [27] C. Madland and G. Richards, "Enhancing student-student online interaction: Exploring the study buddy peer review activity," *International Review of Research in Open and Distributed Learning*, vol. 17, no. 3, pp. 157–175, 2016.
- [28] J. Choi and A. Walters, "Exploring the impact of small-group synchronous discourse sessions in online math learning," *Online Learning*, vol. 22, no. 4, pp. 47–64, 2018.
- [29] G. E. Stephens and K. L. Roberts, "Facilitating collaboration in online groups," *Journal of Educators Online*, vol. 14, no. 1, 2017. <https://eric.ed.gov/?id=EJ1133614>
- [30] J. Kritzer and J. Bogan, "Favorability of strategies to facilitate online group work," *Journal of Educators Online*, vol. 17, no. 2, 2020. <https://eric.ed.gov/?id=EJ1268672>
- [31] G. H. E. Gay and K. Betts, "From discussion forums to eMeetings: Integrating high touch strategies to increase student engagement, academic performance, and retention in large online courses," *Online Learning*, vol. 24, no. 1, pp. 92–117, 2020.
- [32] M. M. Mahmud and S. F. Wong, "Fusing the Jigsaw method and Microsoft teams: A promising online pedagogy," *International Journal of Learning, Teaching and Educational Research*, vol. 20, no. 11, art. no. 11, 2021.
- [33] G. M. Jacobs and F. M. Ivone, "Infusing cooperative learning in distance education," *TESL-EJ*, vol. 24, no. 1, 2020. <https://eric.ed.gov/?id=EJ1257225>
- [34] C. Graham, J. Borup, S. Tuiloma, A. M. Arias, D. M. P. Caicedo, and R. Larsen, "Institutional support for academic engagement in online and blended learning environments: Exploring affective, behavioral, and cognitive dimensions," *Online Learning*, vol. 27, no. 3, pp. 4–40, 2023.
- [35] A. M. Haftador, F. Shirazi, and Z. Mohebbi, "Online class or flipped-jigsaw learning? Which one promotes academic motivation during the COVID-19 pandemic?" *BMC Medical Education*, vol. 21, no. 1, p. 499, 2021. doi: 10.1186/s12909-021-02929-9
- [36] Z. Moosavi and D. DeWitt, "Online distance learners' perceptions and needs for personalized learning in English as a foreign language courses," *Malaysian Online Journal of Educational Sciences*, vol. 11, no. 2, pp. 37–49, 2023.
- [37] S. Yu and T. Yuizono, "Opening the 'Black Box' of cooperative learning in face-to-face versus computer-supported learning in the time of COVID-19," *Education Sciences*, vol. 11, no. 3, art. no. 3, 2021. doi: 10.3390/educsci11030102
- [38] D. Garrison and J. B. Arbaugh, "Researching the community of inquiry framework: Review, issues, and future directions," *Internet and Higher Education – INTERNET HIGH EDUC.*, vol. 10, pp. 157–172, 2007. 10.1016/j.iheduc.2007.04.001
- [39] A. T. Peterson, P. N. Beymer, and R. T. Putnam, "Synchronous and asynchronous discussions: Effects on cooperation, belonging, and affect," *Online Learning*, vol. 22, no. 4, pp. 7–25, 2018.
- [40] S. T. Imran, "Socialization techniques in online higher learning: Creating a sense of community, and the impact on student retention," *Online Submission*, 2022. <https://eric.ed.gov/?id=ED624343>
- [41] Z. Y. Yakar, "The effect of the online flipped learning model in higher education: Examination of students' engagement, views and experiences," *Asian Journal of Distance Education*, vol. 18, no. 2, pp. 75–93, 2023.
- [42] B. Wempe and R. A. Collins, "Students' perceived social presence and media richness of a synchronous videoconferencing learning environment," *Online Learning*, vol. 28, no. 1, pp. 22–43, 2024.
- [43] N. A. Okla, E. A. Rababa, S. Belbase, and G. A. Murshidi, "The influence of collaboration, participation, and experience on undergraduate learner engagement in the online teaching-learning environment," *Online Learning*, vol. 27, no. 3, pp. 155–187, 2023.
- [44] M. Aghajani and M. Adloo, "The effect of online cooperative learning on students' writing skills and attitudes through telegram application," *International Journal of Instruction*, vol. 11, no. 3, pp. 433–448, 2018.
- [45] L.-M. Norz, V. Dornauer, W. O. Hackl, and E. Ammenwerth, "Measuring social presence in online-based learning: An exploratory path analysis using log data and social network analysis," *The Internet and Higher Education*, vol. 56, 100894, 2023. doi: 10.1016/j.iheduc.2022.100894
- [46] R. Pekruna, "Commentary: Self-Report is indispensable to assess students' learning," *Frontline Learning Research*, vol. 8, no. 3, pp. 185–193, 2020.
- [47] S. Androwkha and A. Jézégou, "Socio-cognitive presence during a collective and synchronous distance activity: An empirical study carried out with three groups of teachers in a training situation," *Ritpu*, vol. 16, no. 3, pp. 22–38, 2019 (in French). doi: 10.18162/ritpu-2019-v16n3-02
- [48] A. Aslan, "The evaluation of collaborative synchronous learning environment within the framework of interaction and community of inquiry: An experimental study," *Journal of Pedagogical Research*, vol. 5, no. 2, pp. 72–87, 2021.
- [49] Y. Cai, Z. Pan, S. Han, P. Shao, and M. Liu, "The impact of multimodal communication on learners' experience in a synchronous online environment: A mixed-methods study," *Online Learning*, vol. 26, no. 4, pp. 118–145, 2022.
- [50] K. Achuthan, V. K. Kolil, S. Muthupalani, and R. Raman, "Transactional distance theory in distance learning: Past, current, and future research trends," *Contemporary Educational Technology*, vol. 16, no. 1, 2024. <https://eric.ed.gov/?id=EJ1417309>
- [51] Y. Hu, R. Ferreira Mello, and D. Gašević, "Automatic analysis of cognitive presence in online discussions: An approach using deep learning and explainable artificial intelligence," *Computers and Education: Artificial Intelligence*, vol. 2, 100037, 2021. doi: 10.1016/j.caeai.2021.100037

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