Inclusive Online Collaborative Learning Environments: Implications for Teaching, Social, and Cognitive Presence

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Abstract

The rapid pivot to online learning during the COVID-19 pandemic has permanently transformed education, elevating e-learning to a global mainstream modality while exposing new opportunities and challenges. This paper summarizes the study from Kaufmann *et al.* (2022), and examines professional education in the context of the Erasmus+ Ka226 Project, focusing on the interplay between instructional, technological, and mental health paradigms that underpin inclusive online collaborative learning. The paper focuses on three foundational pillars: teaching presence, social presence, and cognitive presence. Effective teaching presence necessitates both instructors and students to develop digital and communication competencies, fostering student autonomy and readiness for technology-linked work environments. Social presence is explored through the lens of collaborative learning theory and cultural diversity, highlighting the need for adaptive communication strategies and community building in virtual settings. Cognitive presence is addressed through innovative instructional strategies and the increasing relevance of AI and learning analytics to personalize learning, accommodate diverse cognitive profiles, and facilitate key learning outcomes. This commentary also draws attention to the persistent mental health stressors associated with online participation, including isolation and accessibility limitations, underlining the importance of differentiated instructional design and assistive technologies. Empirical findings emphasize substantial dissatisfaction and ambiguity among learners regarding their online collaborative experiences, with infrastructural and institutional barriers persisting. Research calls for research into adaptive and inclusive design—especially for neurodiverse learners—and advocates for integrated mental health supports within curricula. Ultimately, the evolving online educational landscape demands empathetic, culturally-aware, and technology-driven instructional design, with AI poised to redefine teaching and learner differentiation in the years ahead.

Keywords: Online collaborative learning (OCL), Teaching presence, Social presence, Cognitive presence, Inclusive pedagogy, Learning styles, Assistive technology, Mental health, E-learning, AI, Artificial intelligence

Introduction

During the COVID-19 pandemic, education practices were globally affected as they had to be swiftly innovated and adapted their learning and teaching toward an online learning environment [1–3]. E-learning had to overcome a plentitude of obstacles [4,5]. Today, online learning has evolved to a "mainstream teaching and learning mechanism" [2] also facilitating the recruitment of global learners. Although virtual learning is now a central educational element [6], several so far unknown consequences of online collaborative and

inclusive learning remain. Teachers are not recommended to simply transfer the traditional pedagogy to the online variant, but to re-invent their role. Whilst the instructor-student engagement is still preferred by online learners, the instructor becomes more a strategic designer of the collaborative, inclusive and equitable learning environment, a learning catalyst, mentor/coach and motivator by integrating the pedagogical contributions of digital systems and tools with students becoming co-creators of the educational experience. This paper represents a concise summary and commentary of Kaufmann *et al.*'s [7] work focusing on these and other

instructional, technological and mental health related challenges in professional education (Erasmus+ Ka226 Project 'Creation of a collaborative environment in e-classrooms; project number: 2020-1-DE02-KA226-VET-007926) and providing suggestions for future research.

Foundational Pillars

A successful online learning strategy needs to comprise three interconnected core dimensions:

- Teaching presence (design and facilitation)

- Social presence (learner and teacher connection and interaction)

- Cognitive presence (active knowledge construction in a community of inquiry).

Teaching presence

Referring to the pillar of teaching presence, students and teachers alike, in order to conscientiously perform online learning, need to be familiarized a priori with effective online learning skills, technologies (i.e. multimedia and e-learning platforms) [8,9] and communication skills [6,10]. Particularly, learners need to be trained so self-monitor, self-motivate and self-regulate themselves so as to achieve their learning goals [11,12]. The resulting skills are in high demand for the soon-to-be employees when they start their professional career. Latter is increasingly driven by a synthesis of technical and social competences, flexibility and self-organization [13,14]. In this way, a smooth transition between education via technology and professional work is achieved. This e-learning and e-teaching readiness is statistically linked to student engagement in online learning environments as well as to academic resilience [15].

Rubens *et al.* [16], proposed seven design principles for developing educational technology, such as facilitating knowledge building, scaffolding inquiry, and supporting community formation. Technology related aspects affect learners' satisfaction in online collaborative learning (OCL) environments. Factors influencing learners' satisfaction include content quality, course design, instructor presence, and platform usability [6,17–20]. The project at hand [7] revealed amongst others following factors: availability of tools, a powerful internet, constant and new applications, relevant training, and, interestingly, missing face-to-face learning. Sadly, more than 25% of the project's respondents are dissatisfied or very dissatisfied with their current online collaborative learning environment in their respective institutions with additional 30% of participants being indeterminate on that point.

A variety of (AI-driven) digital tools for synchronous learning facilitating social interaction (i.e. video conferences, webinars, live chats) and asynchronous learning facilitating self-direction (i.e. forums, wikis, text chats or file sharing platforms) can support collaborative learning instead of fostering pedagogy-driven isolation [21–23]. However, effectiveness varies: video conferencing supports rich interaction, while text chats are less effective for deeper discussion [24]. The project at hand suggests Moodle as a learning management system (LMS).

Social presence

As to Social Presence, the theoretical underpinning of collaborative learning lies in social constructivism, which views learning as a social process. Collaborative learning (CL) is a pedagogical strategy where learners work together to solve problems or complete tasks while appreciating each other's abilities, responsibilities, and perspectives. Current findings stress the importance of inclusive practices in three areas: accessible content, inclusive pedagogy and design and inclusive teaching [6,22–25]. Interestingly, Hernández-Sellés *et al.* 2020 [26] call for the establishment of a collaboration culture catalyzing the cognitive, social, and organizational/teaching for better knowledge convergence as social aspects are challenging for learners [27]. The cultural components to be considered relate to diverse ethnic, local, academic and disciplinary ones which e-learning providers are facing [28,29]. The globalization of online education necessitates to introduce cultural diversity into virtual classrooms. The respective cultural background influences collaboration styles, learning preferences, and student-teacher expectations, i.e., the virtual learning environment and experience [29,30]. For example, learners from collectivist cultures may favor collaborative work and structured guidance, whereas individualistic learners prefer autonomy. Popov *et al.* 2014 [31], found that both cultural groups struggled with the absence of non-verbal cues in online environments. To bridge these gaps, Economides 2008 [32] recommends tailoring communication and collaboration tools to individual cultural profiles, ensuring balanced participation and clearer interaction. Practical cultural considerations also include language choice, course fees, and certificate recognition, as highlighted by Porto *et al.* [33] in courses by the Inter-American Development Bank. Therefore, it is of paramount importance to consider culture as a key factor which has to guide the development of e-learning programs [34].

Research has shown that CL fosters higher achievement, better relationships, improved self-esteem, and social competence compared to individualistic learning methods, if they are used on a regularly basis [35–37]. Knowledge is co-constructed through interactions, with emphasis on reflection and connection to prior experience, underlining that learning as a group is a different kind of learning experience based on

interaction [30,37–39]. A study on an international Master's program 2009 [40] outlined ten strategies for fostering effective group collaboration, including learner readiness, clarity of task, scaffolding, and community building. Key among them is the instructors' reflection on their influence over group dynamics. This CL philosophy carries into Online Collaborative Learning (OCL) and Computer Supported Collaborative Learning (CSCL) with digital environments enabling synchronous and asynchronous learning.

Despite technological advancements, transferring collaborative methods to online settings poses challenges. Instructors often find that their face-to-face strategies do not yield the same outcomes online while learners' satisfaction is predominant in online as well as blended learning and insignificant in face-to-face learning environments [41,42]. In Germany, barriers like poor infrastructure and lack of institutional IT support have hindered progress 2017 [43]. However, collaborative group work can also lead to frustrations with group members, often due to unequal effort, poor communication, or unclear roles [44,45]. Understanding group dynamics and frustrations [45,46] is crucial for instructors to manage expectations and build productive learning communities.

Online instructors must intentionally design inclusive, cognitively engaging learning spaces to stimulate curiosity and equitable participation meeting the learners' needs, e.g., via multiple channels and by being particularly vital which affects student engagement [45,47,48]. Particularly, the interaction between learners, i.e., students, is in the limelight, as it is statistically significantly associated with motivation of students [6,49–51]. Additionally, as the relationship between motivation for learning as well as perceived learnings is significantly and positively mediated by student satisfaction [6], the origins of motivation are highly relevant as well. If students hide behind the camera, motivation is reduced [7], which underlines that a kind of social control among the students via group work or other types of collaboration might enhance motivation. Furthermore, instructors have to deal with hiding behaviors via communication, group work, or other pedagogical instruments [7].

Cognitive presence

As to the components of cognitive presence, the collaborative knowledge construction, Sadaf, Wu and Martin [52, p. 9] refer to instructional strategies such as "reflection on practice, case-based learning, inquiry based learning and peer facilitation, debate, project-based learning, collaborative learning, role play, scaffolding, article critique, instructor facilitation, invited expert and roles assignment" to achieve the following learning outcomes: differentiating as to "levels of cognitive presence—triggering, exploitation, integration and resolution—critical thinking and interaction". Resulting from a systematic

literature review, suggestions for research relate to enforce existing and integrate innovative instructional strategies, the triggering and resolution levels of cognitive presence as well as including social network analysis and thematic analysis at the implementation stage. Additionally, the influence of other learning environments, such as video-based, learning management systems or the Metaverse on cognitive presence is suggested for further research. An emphasis on the instructor role as to course design, facilitation of collaboration and instructional strategies point to necessary future research on the nexus of the three presence pillars. In future, this nexus is anticipated to be significantly affected by artificial intelligence (AI), i.e., as AI-instructors. By now, the usage of AI is limited in higher education [53] and students prefer for instance a personal feedback from instructors instead of an AI-generated feedback, which might lead to better results in exams [54]. Nevertheless, AI is also associated with having the power to modernize educational processes, as, for instance, chatbots can be supportive along the educational journey [55]. Again, training and a critical reflection on educational consequences of modern technologies is important. Just as both parties need to learn how collaborative online teaching works, a foundation in AI use needs to be provided. Instructors who are very conservative are particularly reluctant to use AI [56]. As a result, personal attitudes toward AI also give rise to different pedagogical teaching and learning concepts that affect students (more or less AI competence) [56], which can have long-term consequences, such as poorer opportunities on the job market.

Relating to the nexus of teacher's and cognitive presence, instructional design must take the diverse learning styles (i.e., visual, auditory, kinesthetic) of students into account. Relating to cognitive presence, the concept of learning style is an active constructive search for meaning which is perceived and learned by every individual in different knowledge forms. Learning styles are a "composite of characteristic cognitive, affective, and physiological factors that serve as relatively stable indicators of how a learner perceives, interacts with, and responds to the learning environment" [57, cited in Shahabadi and Uplane (2015, p. 130), 58]. In addition, these learning styles may differ, for example, as to age, level of achievement, culture, global vs. analytical approach, processing preferences, gender or special needs. These learning styles must be integrated in a community of inquiry to help students from different cultures, gender, age, background etc. share their ideas, work in a team, identify each other's strengths and weaknesses and initiate productivity in assignments.

Emphasizing the inclusive character of teaching, the project at hand puts emphasis on tailoring the instructional design to diverse preferred learning styles, such as: Kolb's [59] learning style (concrete experience, reflective observation, abstract conceptualization, active experimentation) to be combined with preferences of perceiving and processing information

(diverging- feel & watch-; assimilating - think & watch-; converging - think & do-; and accommodating - feel & do-); Felder Silverman 1988 Learning and Teaching styles [60]; diverse cultural (i.e. individualistic vs. collectivistic) learning perspectives (previous educational experience; different perspectives on competition; student-teacher relationships; learning methods); digital literacy learning styles, i.e., in combination with deep learning approaches (collaboration, creativity, critical thinking, citizenship, character and communication) in relation to meta-cognitive learning strategies [61].

AI and Machine Learning is suggested for identifying the respective learning styles. Two classification types identified are: supervised and unsupervised. The first type enables the user to select a training data set and perform the classification algorithm on it. Providing a relevant recommendation to the learner means identifying the characteristics of the learner such as the age, level of attainment or maturation, ability, aptitude, and capability and accordingly select relevant materials for their needs, interest, and aspirations. The outcomes of the second one are based on the software analysis of the elements, without the user defining sample classes and provide more personalized and engaging learner experience, lead to a better course flow and recommends relevant material to the users based on different algorithms (like content-based, collaborative filtering, social networking, knowledge-based, and group-based approaches).

Mental Health, Wellbeing, and Inclusion in Online Environments

Truly inclusive and collaborative learning needs to be effectively designed to mitigate potential mental health problems arising from traditional online learning and facilitate an equitable participation of students with mental problems. As to the first aspect, students experience higher levels of stress and depression when they participate in online learning regularly [62]. Stress and anxiety increased during the massive online learning period due to the COVID-19 pandemic [63]. Moreover, students have felt isolated due to online learning, especially in comparison to face-to-face learning, which negatively impacts mental health [64–66]. They felt alone, separated from classmates as well as instructors [66], and reduced personal interaction further increased feelings of burden and isolation [67]. This is reflected in many research papers on online-learning during COVID-19 pandemic pointing to inappropriate application of collaborative learning at this early stage of development: lack of teachers' skills to design collaboration and interaction [68]; lacking social exchange opportunities between fellow students and teachers [68]; concerns on lacking socialization, co-operation and communication [68]. These challenges, if unaddressed, erode students' mental resilience and can lead to a rejection of online environments, as observed with students in Dubai [56].

Therefore, students in Dubai preferred traditional learning environments, i.e., on campus [68]. To redress the balance, mental health trainings and programs should be integrated into online curricula [69]. Currently, AI can analyse students' language use to assess their mental health status [70]. This enables instructors to intervene early, potentially preventing more severe mental health impairments [70].

Implicitly, in some cases, the benefits of effective CL claimed by Laal & Laal [35] and Laal & Ghodsi [36] and neglected in these early stages such as higher achievement, better relationships, improved self-esteem, and social competence seem to be confirmed albeit continuous technology support seems necessary. In other cases, Sadaf's, Wu's and Martin's [52] suggestion to expand research on learning formats including other than exclusive online learning components such as blended or flipped learning might be a promising route to follow.

Relating to the second aspect of the introductory sentence, invisible disabilities (e.g., ADHD, PTSD, dyslexia) are often overlooked, requiring subtle but impactful accommodations from the very outset of instructional design.

In this context, literacy learning styles need to be adjusted as to the specific learning disabilities and supported by relevant assistive technology. Students with disabilities often face barriers in OCL environments. Many platforms lack compatibility with assistive technologies like screen readers [71], and educators are often unaware of how to design for diverse abilities. Assistive Technology refers to any item, product, or equipment that is used to improve functional capabilities of learners with disabilities, according to the Individuals with Disabilities Education Act (IDEA) law.

Assistive technology can improve the writing skills of students with learning disabilities. Assistive technology can help students to bypass the mechanical aspects of writing. Using spell check and grammar features can help students focus on communicating their ideas and students can write with confidence knowing that they can easily make changes. Text-to-speech (e.g., Kurzweil 3000), speech-to-text (e.g., Dragon Naturally Speaking), word prediction (e.g., WordQ) and graphic organizers (e.g., Inspiration) are four useful software functions for students who struggle with language-based learning disabilities. Other assistive software functions relate, for example, to pentop computers, calculators, math software, Speech Recognition Software, Speech Synthesizer, Alternative Keyboards and Mice, Braille Support, Proofreading Programs, Talking Calculator or Screen readers.

In addition, computer-assisted instruction provides immediate and dynamic feedback, and students with learning disabilities can benefit from this non-judgmental computerized practice.

Against this backdrop, intentional instructional design supported by assistive technology driven digital strategies positively affect the cognitive load of learners. The impact of technostress such as overload, invasion, complexity, privacy and inclusion, for example, needs to be differentiated as to high-stress learners (resulting in cognitive overload and decreased performance) and low-stress learners (moderate impact and improved performance) [71]. Latter authors developed technostress reducing technostress through interface design, multimodal interactions and virtual reality training. Another example relates to the previously mentioned COVID period where exclusive online learning rendered a feeling of isolation and a declined cognitive function [72]. As a further example, digital platforms multitasking or frequent switching might trigger accessibility barriers experienced especially by learners with Attention Deficit Hyperactivity Disorder (ADHD) suffering from functional limitations [73].

Le Cunff, Giampietro und Dommett [72], in this context, suggest to differentiate as to cognitive differences of neurotypical and neurodiverse learners focusing on the influence of the instructional design on their respective cognitive load, the amount of working memory they used for learning outputs. This is suggested as another promising AI contribution. The authors refer to the Cognitive Theory of Multimedia Learning, according to which working memory should be minimized, to facilitate information flow and storage to and in the learners' long-term memory. Implying a nexus between teacher's, social and cognitive presence, their systematic literature review elicited three factors influencing cognitive load in online learning: cognitive/emotional, instructional and social factors. The authors suggest interesting avenues for future research and even more inclusive instructional design: "Our findings reveal a major research gap, as most studies overlook the distinct neurocognitive profiles of neurodivergent students. Notably, ADHD and ASD learners may exhibit unique cognitive load responses, suggesting that established cognitive load theories and instructional design guidelines might not uniformly be applicable in neurodiverse classrooms. Lastly, inconsistent methodologies in measuring cognitive load in online learning point to the need for more uniform research approaches. Future research should prioritize creating adaptive, inclusive online learning environments that respect and accommodate cognitive differences, which will not only benefit neurodivergent students but also enhance the online learning experience for all students" [72, p. 16].

Conclusion

Creating inclusive online collaborative learning environments requires thoughtful integration of pedagogy, technology, cultural awareness, learner differentiation (learning styles and cognitive load) and accessibility. While technologies offer powerful tools to enhance learning, the role of the instructor changes but remains central in planning for and caring for engagement, equity, and inclusion. Designing online learning with empathy, cultural sensitivity and technological savviness, ensures that all learners—regardless of background or ability—can meaningfully participate in and benefit from collaborative online education.

Collaborative inclusive online learning has several advantages for students (accessibility, social and cultural competence or good preparation for the job market), for instructors (higher degree of flexibility and more personalized education) and higher education institutions (improved recruitment from new markets). Furthermore, to date first attempts to include AI in online learning are observed, but the possibilities in the future are unlimited. After a careful critical reflection, AI can support and even replace certain instructional tasks in online education in the future.

Conflicts of Interest

None.

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