ACADEMIC SUCCESS IN
SYNCHRONOUS ONLINE LEARNING ENVIRONMENTS

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ABSTRACT

The study aimed to analyze the influence of such factors, as cognitive engagement, learning strategies and social support on academic success and student satisfaction in online learning environments. Data were collected in a cross-sectional survey carried out in the Winter semester of 2023. Participants were 523 students recruited from universities located in Southern Italy, where the synchronous online learning modality was adopted. The questionnaires included self-reported measures assessing student satisfaction and academic achievement, social support (teacher and peer presence), and deep and shallow cognitive engagement, in an effort to collect data regarding the dynamics of online learning experiences with respect to the three interdependent presences of teaching, cognitive and social, as put forth by the Community of Inquiry (CoI) framework (Garrison et al., 2001). Descriptive analysis, bivariate associations, and regression analyses were applied to the data. Data showed different patterns of relationships between academic success and predictors. Deep cognitive engagement was positively associated with academic achievement but unrelated to satisfaction, whereas no significant associations emerged between shallow cognitive engagement, academic achievement, and satisfaction. Furthermore, social presence was found to be unrelated to students' satisfaction, deep cognitive engagement, or shallow cognitive engagement. The findings of the current study provide professionals in the field of education with suggestions for synchronous online-based teaching about ways to plan a community learning space where teacher-student interactions as well as peer interactions are fostered. This more collaborative-constructivist perspective could improve students' academic achievements.

INTRODUCTION

The European Union's Lifelong Learning Program invites higher education and adult learning institutions to consider ways of providing stimulating learning experiences to people at any stage of their lives, taking into account current societal transitions. As the educational landscape evolves, it accommodates a more diverse audience of individuals accessing educational content. It is essential to ensure these individuals have equal access opportunities to promote the quality of their educational experience, considering factors such as age, work and family commitments, or distance, which may hinder participation in physical educational activities.

In the current dynamic educational landscape, proposals have emerged, advocating the use of digital technologies to enhance the flexibility and accessibility of educational resources geared toward diverse and extensive groups of learners (Cain, 2015). Asynchronous communication systems serve as a technological solution that blurs the boundary between in-person and remote educational models. The systems continue to improve in terms of functionality and efficiency, paving the way for new hybrid synchronous approaches, known as blended approaches (Alexander et al., 2014; Bower et al., 2015). As a result, contemporary education policies now consider the prospect of multi-campus learning and inter-institutional collaboration through connecting virtual groups and classrooms with traditional physical classrooms (Raes et al., 2020).

In the period 2020-2021 the introduction of safety measures to contain the spread of the COVID-19 has led to social/physical distancing and sudden lifestyle changes, such as deprivation of social contact with peers and isolation, school closures for more than 1 billion learners worldwide - almost 70% of the world's student population (UNESCO, 2019) - and distance learning, thus affecting quality of life, mental health and learning achievement (Vaillancourt et al., 2021; Bonvino et al., 2023). In facing several phases of lockdowns, teachers and educators had to quickly transition from face to face to online lessons and to adopt new forms of online teaching in order to maintain student engagement. Among them, the synchronous online learning environment is believed to become "a learning paradigm shift in the post-corona era" (Ji, Park, & Shin, 2022, p.1).

Therefore, in light of the emergency transition to online learning during the COVID-19 pandemic, the main aim of this investigation was to evaluate if synchronous online learning positively affected students' learning process and their academic achievement and satisfaction. To this purpose, the study draws upon two frameworks, the community-based model and the engagement framework.

The Link between the Synchronous Online Learning Environment and the Community of Inquiry Model

Within online educational research, previous studies have generally shown positive effects of blended learning modality (van der Stap et al., 2024) and virtual learning (asynchronous and/or synchronous online learning) not only on academic success (Zou et al., 2021), but also on social components such as a decrease in learners' feelings of isolation (Wise & Cui, 2018). As for social components, they are rooted in Vygotsky's social constructivist theory (1978) according to which knowledge is co-constructed and individuals learn from one another in a knowledge community. Under the umbrella of the generic community definition and in line with John Dewey's (1938) examination of the nature of knowledge formation, the Garrison and colleagues' (2001) conceptual framework of the Community of Inquiry (CoI) was used in this investigation as a guide to structure the online course. It was assumed that, in the lack of face-to-face interaction, individuals in online learning environments must exert efforts in recreating the social and knowledge building mechanisms present in in-person classrooms, such as the moment by moment negotiation of meaning. Therefore, the CoI approach could perfectly be adopted to the synchronous online learning modality, as a form of learning in which participants interact with each other and instructors in real time.

Defined as the ability of participants in a community of inquiry to project themselves socially and emotionally as 'real' people (i.e., their full personality) through the medium of communication being used" (Garrison et al., 2000, p. 94), social presence is essential for collaborative learning and, therefore, it could represent

the core element of this framework. Indeed, students need to feel the affective or psychological presence of others to avoid feeling isolated and demotivated (e.g. Ali & Smith, 2015; Bouilheres et al., 2020; Rasheed et al., 2020). In this direction, when social presence is established, it acts as a support for cognitive presence, indirectly facilitating the process of critical thinking carried on by the community of learners (Garrison et al., 2000; Gutierrez-Santiuste et al., 2015).

The CoI model posits a collaborative-constructivist perspective which is useful to understand the dynamics of an online learning experience taking into account the following three interdependent presences: teaching, cognitive and social. The first (TP) comprises three areas of responsibility, i.e., design, facilitation, and direct instruction, associated with the integration of social and cognitive processes. The second (CP), which consists of four phases – triggering event, exploration, integration, and resolution/application (Garrison, Anderson, & Archer, 2001) – mirrors the purposeful nature of collaborative knowledge construction foreseen by constructivist educational experiences. Finally, the third presence (SP) includes three categories: open communication, group cohesion, and personal/affective projection.

Although the three presences are interconnected and their effects overlap, Garrison and colleagues (2004) assumed a sort of hierarchical sequence among them: TP serves as the pivotal dimension leveraging SP, which activates and propels the collaborative process of CP. Therefore, SP could play a mediating role between TP and CP, fostering open communication and group cohesion in line with the constructivist perspective.

Community of Inquiry and Online Learning Outcomes

A recent qualitative synthesis based on 23 studies adopting the CoI framework and carried out before the pandemic period (Kim and Gurvitch 2020) found that the majority of university courses based on CoI were in the field of Education, followed by Business, Nursing, Engineering, Computer Science and Science and that the asynchronous online courses were the most common delivery type throughout the educational level, accounting for 72% of all delivery types. In addition, when examining the learning outcomes related to the application of CoI, the same systematic review categorized the type of the learning variables according to two criteria: the first as a subjective estimation reported by students themselves or as an objective/external rater; the second one as the learning process or product. By interacting the two criteria the structure of the observed learning outcomes revealed four main sections: (a) subjective learning product referred to students satisfaction and self-reported achievement (b) objective learning product, such as exam score or assignment score, (c) subjective learning process including meta-cognition, engagement, efficacy and self-regulation, and (d) objective learning process involving time spent on task or frequency of tool use. The review showed a significant increase of interest in the online teaching environment among researchers given the positive effects of the CoI model and suggested plans for future studies during the pandemic or post-pandemic period to assess students' academic success.

In this vein, a recent investigation showed that, although all the three elements of CoI were good predictors of course satisfaction, social presence was the strongest determinant to students' satisfaction. Social presence had a role as facilitator in cognitive development and critical thinking in online learning (Yandra et al., 2021). In line with this result, others data indicated that, when students are involved in synchronous online learning environments, social presence positively correlated with higher levels of satisfaction (Andel et al., 2020; Ji, Park, & Shin, 2022; Zhong et al., 2022) and academic achievement (Al-dheleai et al., 2020).In addition, teaching presence was found to be positively associated with students' satisfaction (Turk, Heddy, & Danielson, 2022; Yoo & Jung, 2022). Finally, a recent meta-analysis (Yu & Yu, 2021) concluded that online learning outcomes were significantly higher than the traditional learning outcomes during the pandemic period.

However, the role of cognitive learning processes associated with the social and teaching presence in online synchronous learning has been less investigated during the pandemic period. This is an important aspect, since cognitive processes underlying learner engagement could impact academic achievement and satisfaction.

Learning Engagement and Academic Success in Online Learning

The literature on online learner engagement is continually developing, despite years of research on this topic. In distance and online learning literature it is defined as "the student's psychological investment in and effort directed toward learning, understanding, or mastering the knowledge, skills, or crafts that academic work is intended to promote" (Newmann, Wehlage, & Lamborn, 1992, p. 12). Lear and colleagues (2010) supported the idea that interactions with content, peers, and instructors help online learners become active and more engaged in their courses, and that the emerging sense of community leads to a high-quality instruction and more effective learning outcomes.

The pandemic period characterized by transactional distance between learner and instructor had added another barrier to learner engagement, thus leading to much efforts to increase the amount of dialogue, structure, and autonomy between course participants. In psychological literature engagement is conceptualized as a complex and multidimensional construct and it includes behavioral, cognitive, and affective aspects (e.g., Fredricks et al., 2004). The first typically focuses on students' learning behaviors such as effort, persistence, attention, and concentration; the second on the cognitive processes of learning such as the applications of deep or shallow strategies during learning activities and the last one on students' feelings toward learning activities, such as positive or negative emotions. In line with this conceptualization, the current study is focused on the second aspect as a further determinant of academic success. Operationalized as cognitive engagement, this concept refers to self-regulated or strategic learning (Fredricks et al., 2004) and includes two components, deep and shallow (Greene, 2015) strategies. The former involves high-order or meaningful processing strategies linking new material to prior knowledge (Greene, 2015; Ravindran, Greene, & DeBacker, 2005) and thus positively influencing learning performance (Bolliger & Halupa, 2018; Liu et al., 2022); the second involves more mechanical memorization strategies and other rote processing actions (Xie, Heddy, & Greene, 2019), thus negatively influencing learning performance (Greene & Miller, 1996).

However, limited research investigated the effects of students' cognitive engagement on satisfaction and academic achievement in online learning environments. Dinh (2023) has recently reported that deep learning strategies were found to be positively related to academic achievement but unrelated to students' satisfaction, as well as no significant associations between shallow learning strategies and academic success. Furthermore, when focusing on the associations between learner cognitive engagement and the key elements of the CoI model, previous studies showed that a positive direct effect of teaching presence on deep processing strategies in blended synchronous learning environments (Zhang et al., 2016; (Shi, Tong, & Long, 2021; Zhong et al., 2022; Wang and Stein, 2021), while social presence was unrelated to cognitive engagement in synchronous learning environments (Shi, Tong, & Long, 2021). However, other studies revealed that social interactions played an important role in enhancing students' satisfaction and learning engagement in asynchronous and synchronous courses (Cheng & Chau, 2016; Zhong, Wang, Lv, Xu, & Zhang, 2022), students' outcomes and satisfaction (Richardson, Maeda, Lv, & Caskurlu, 2017; Andel et al., 2020).

Research Aim and Hypotheses

Previous studies examined academic success in association with the core elements of CoI in online learning, but limited studies focused on the examination of the learner engagement in community-based online learning. Therefore, with reference to reviewed literature the current study further contributed in this direction by integrating the community based model with the learner engagement framework underlying students' cognitive processes. In line with the above-mentioned categorization of learning outcomes defined by Kim and Gurvitch (2020), the research examined the effects of the online synchronous environment incorporating the two core elements of the CoI model (teaching and social presence) on the subjective measures of the learning product, which is referred to academic achievement and students' satisfaction, by taking into account the role of students' cognitive learning strategies in such relationships. Hence, the following hypotheses were postulated:

H1: positive associations between the two key elements of the CoI model, social presence and teaching presence;

H2: positive associations between students' cognitive engagement, namely deep and shallow learning strategies, and students' satisfaction and academic achievement;

H3: teaching and social presence are linked to both learning strategies;

H4: academic success is predicted by the two constructs of the CoI framework and by the two learning strategies.

METHOD

Procedure

The study was conducted in the second semester of 2021 and in accordance with the European Code of Conduct for Research Integrity (ECCRI) on human experimentation. In conducting this investigation, the researchers adhered to the ethical standards set forth in the Ethical Code of the Italian Association of Psychology (AIP).In addition, the local Ethics Commission of the University approved the survey protocol (with code number: 51/022021). The anonymity of the data was guaranteed, and no personal information was gathered from the participants. All participants signed an online informed consent to agree to be voluntary respondents for the study without any coercion. They could withdraw from the survey at any time and for any reason. In order to understand the students' satisfaction and academic achievement on the basis of the online course, the survey was completed by students after their end-of-semester examination.

Data Analysis

Cross-sectional design was applied to test the hypotheses. Before testing the hypothesized associations, those instruments without any translated were subjected to a translation process into Italian language by two independent native English professional speakers with previous experience in education research and according to the forward and backward method. The two translated versions were then unified into a single version and reviewed against the original one to identify any discrepancies in meaning or mistranslations. No inconsistencies were found. The last step consisted of a pilot testing among a small group of participants to assess the easy readability and understanding of the items.

The empirical assessment of the soundness of the constructs, that is the face validity of the instruments, was checked by researchers of the current study. For the content validity, the Content Validity Index (S-CVI) of the overall scale was calculated on the basis of Lawshe's method (1975). The critical CVI value - which allows accepting or rejecting the content validity of the instrument - is equal to 0.80 (Davis, 1992). For each instrument it was ascertained the construct reliability by assessing the convergent validity with average variance extracted (AVE) value and the Composite Reliability index (CR), and the internal consistency value with Cronbach's alpha coefficient.

To test the supposed relationships of associations bivariate correlations between the constructs were conducted. Finally, linear regression analysis was used to assess factors associated with students academic success (considered as a composite score). Responses to the survey were aggregated and applied to statistical analysis using SPSS.

Participants

Participants were 523 students recruited from universities located in Southern Italy, where synchronous online learning modality was adopted (convenience sampling; Robinson, 2014). They received a link to a Consent Form and to the Questionnaires. Only 447 respondents (Males = 208, Females = 239; M_{age} = 21.30, SD =2.1) completed all questionnaire scales and were eligible for data analysis, thereby meeting the

minimum sample size required for a significance level of 5%. Most participants were studying in the discipline of education (55.5%),the remaining part in arts and humanities sciences (14.5%). Table 1 shows students' characteristics.

Table 1. Respondents' Demographic Profile

Gender	Age (mean)	Frequency	Percentage
Male	22.20	208	46.54%
Female	29.80	239	56.46%
TOTAL	---	447	100.00%
Educational Science			
- Male		178	46.59%
- Female		204	53.40%
- TOTAL		382	85.50%
Art and Humanities Science			
- Male		30	46.15%
- Female		35	53.84%
- TOTAL		65	14.5%

Instrument and Data Collection

The questionnaire consisted of two parts. The first part included questions related to the participant's demographic characteristics – age, gender, and degree course. The second part consisted of 41 items underlying different factors that participants responded to in the form of a 5-point Likert scale, response options ranging from strongly disagree to strongly agree. The questionnaire was adapted from prior research.

The Italian translation of the 22-item questionnaire of the CoI survey including the two dimensions of social and teaching presence was adapted from Arbaugh et al. (2008). The first component, Teaching presence (TP)**,** included 13 items. Some sample items are: "The instructor clearly communicated important due dates/time frames for learning activities", "The instructor provided feedback that helped me understand my strengths and weaknesses relative to the course's goals and objectives", and "The instructor clearly communicated important course goals". The second component, Social Presence (SP)**,** comprises 9 items. Some examples of items are: "The way the class meets is an excellent medium for social interaction", "I felt comfortable disagreeing with other course participants while still maintaining a sense of trust", and "I felt comfortable interacting with other course participants".

The Cognitive Engagement Scale (CES): the translated version of the 11-item questionnaire referred to students' cognitive engagement (Miller et al., 1996) was used to assess deep and shallow learning strategies. Students make direct estimates of how much effort they expended.for their study with multiple choice item with 5 alternatives: "Extremely high (probably as much effort as I've ever put into a class)" to "Extremely low (probably the least amount of effort I've ever put into a class)." The middle choice was "About average." The deep strategy subscale was composed of seven items. Examples of items are "When studying, I try to combine different pieces of information from course material in new ways" and "I draw pictures or diagrams to help me solve some problems". The second strategy subscale consists of four item, e.g., "I try to memorize the steps for solving problems presented in the text or in class£" amd "When I study for tests I use solved problems in my notes or in the book to help me memorize the steps involved".

The translated version of the 8-item questionnaire referred to students' satisfaction and academic achievement was adapted from Ejubovic and Puska (2019). The first instrument assesses whether students will use online technology for learning purposes and their level of satisfaction with online learning. Some examples of

items are "I will continue learning online in the future" and "Learning online is a pleasant experience". The second instrument evaluated students' improvements in online learning to a larger extent, and whether their team work is better with online learning (e.g., "I have a better exam pass rate when I use online resources" and "My grades are better when I use online resources"). Both instruments are rated on a five point likert scale starting from strongly disagree to strongly agree. High scores indicate higher levels of satisfaction and academic achievement linked to the online environment.

ANALYSES AND RESULTS

Validity and Reliability

The parameters for content validity and internal consistency in terms of Content Validity Index (S-CVI), Cronbach's alpha reliability, composite reliability (CR), and average variance extracted (AVE) were calculated for each scale. Table 2 reports the mean values and standard deviations for each scale and the above-mentioned indexes.

Table 2. Descriptive statistics of the instruments

Dimensions	N. item	Mean (SD)	S-CVI	α values	CR	AVE
Social presence (SP)	9	3.95 (0.79)	0.88	0.93	0.95	0.75
Teaching presence (TP)	13	4.84(0.76)	0.91	0.94	0.95	0.66
Deep processing (DP)	7	3.76 (0.67)	0.83	0.88	0.91	0.67
Shallow processing (ShP)	4	3.18(0.57)	0.80	0.77	0.90	0.81
Academic achievement (AA)	4	4.01(0.67)	0.82	0.88	0.92	0.73
Student satisfaction (SS)	4	3.45 (0.88)	0.89	0.90	0.94	0.84

Cronbach's Alpha values for all the constructs were higher than the suggested 0.7 minimum threshold. Composite reliability which is preferred to Cronbach's Alpha confirmed the reliability of the four instruments with values exceeding the minimum threshold of 0.7. The obtained results are in line with previous findings (Arbaugh et al., 2008; Dihn, 2023; Ejubovic & Puska, 2019; Miller et al., 1996). In addition, the data of the two dimensions of the CoI survey (TP and SP) are in line with previous validated studies among Italian students (Nizzolino et al., 2023). The final criterion for determining internal consistency was the average variance extracted (AVE). According to Hair et al. [67] and Kline [71], the AVE values must be equal to or greater than 0.50. From the table, AVE values ranged from 0.672 to 0.839, satisfying the requirement.

Results

Data from bivariate relationships (Table 3) showed that students' satisfaction was positively linked to academic achievement and unrelated to the other variables; academic achievement was positively linked to deep processing but unrelated with shallow processing; both dimensions of cognitive engagement were significantly related with teaching presence, but unrelated with social presence. Hence, social presence was found to be unrelated with all variables, except the dimension of teaching presence, which belongs to the Community of Inquiry framework.

Hierarchical regression analysis (with stepwise method) was run to explore how academic success (considered as dependent variable in terms of a composite score) was related to the other variables, in order to identify the importance of these variables that account for as much of the variation in the dependent variable as possible. Data showed the overall regression was statistically significant (R^2 = 0.73, $F_{(4, 443)}$ = 23.46, p = < .000); it was found that deep and shallow processing and teaching presence significantly predicted academic success (β = 0.76, p = < .000; β = 0.15, p = < .000; β = 0.68, p = < .000), whereas social presence did not significantly predict academic success (β = 0.60, p = 0.52).

Table 3. Bivariate correlations among the variables

	1	2	3	4	5	6
Social presence	-	0.374**	0.055	0.061	0.042	-0.04
Teaching presence		-	0.513***	0.530***	0.161	0.025
Deep processing			-	0.390**	0.201**	0.161
Shallow processing				-	0.180	0.116
Academic achievement					-	0.631**
Students' satisfaction						-

DISCUSSION

The goal of the current research was to investigate the possible effects of a set of cognitive and social factors on students' academic success and satisfaction in online learning environments. To achieve this purpose, two learning strategies underlying cognitive engagement (deep and shallow processing) and two dimensions operationalising the Community of Inquiry model (social and teaching presence; social support) were taken into account.

The results obtained from correlations supported H1, given the positive association between the two factors of the CoI framework. Although the result is consistent with the empirical data by Arbaugh (2007) and theoretical framework hypothesized by Garrison et al. (2001), the correlation coefficient indicated a moderate association between the two dimensions. In accordance with similar results (Nizzolino et al., 2023; Velazquez et al., 2019) the paramount importance of the dimension of social presence does not seem to be confirmed, thus also confirming some possible adjustments for this dimension which should be more focused on the self in the social context and on the social approach promoted by the teacher, and less on students' emotional perspective.

Findings from patterns of associations partially supported H2 implying significant associations among the two learning strategies, satisfaction and academic achievement. Aligned with the findings by Dinh (2023), the current data indicated that shallow strategy was unrelated with both dimensions of the academic success and that deep processing was significantly associated with academic achievement but unrelated with students' satisfaction. In addition, the observed positive association between the two strategies is not in line with previous research carried out in a traditional learning environment (Greene & Miller, 1996). On the basis of these results, the supposed associations were partially confirmed only for the deep strategy..

With regards H3, significant relationships emerged between teaching presence and both learning strategies, thus partially confirming the supposed associations. Consistently with Dinh's research (2023) such result could be explained by the role adequately played by the teachers when they interacted with the students in the online environments of this study. Indeed, in light of the CoI framework, teacher presence is more precisely shaped when designing online courses (Richardson *et al.*, 2015; Richardson *et al.*, 2016) with reference to design and delivery conditions regarding instructional design, instructor roles and styles, and behaviors and interactions (Richardson *et al.*, 2016). For example, to facilitate learning (e.g., being an active voice in course discourse), teachers should design curricular materials, manage the learning process and environment, and provide a social presence to overcome feelings of isolation among students (e.g., using greetings, names, humor, and self-disclosure; Dennen, Darabi, & Smith, 2007; Richardson *et al.,* 2016). However, the absence of the correlations of social presence with both strategies was not only in line with Dinh (2023) and Shi and colleagues' (2021) studies - even if not aligned with other investigations demonstrating significant relationships with cognitive engagement (Wang, 2022; Zhong et al., 2022) - but also with other researchers, such as Nizzolino et al. (2023) and Velazquez et al. (2019). who affirmed a marginal role played by social presence in synchronous community environments.

A possible explanation could be linked to what Dinh (2023) supposed, that is the lack of relationships of social presence with learner cognitive engagement could be due to the fact that the participants were required to set their cameras on during the real-time and face-to-face interaction with their teacher and peers, and this control over such decisions might have resulted in negative feelings about the synchronous learning online environment.

Finally, the fourth hypothesis, assuming academic success is predicted by the two constructs of the CoI framework, was partially supported, since social presence had no significant effect on academic success.

Conversely, teaching presence and both cognitive processing turned out to be significant predictors of academic success.

If the role played by deep processing and teaching presence in positively affecting academic success were reconfirmed, findings would also demonstrate the positive effect of shallow strategy on academic success. Hence, the current study demonstrated that students characterized by shallow strategy obtained more benefits (higher levels of satisfaction and a better learning performance) from the synchronous online learning context thanks to the teaching roles. To sum up, this investigation pinpointed how synchronous learning context led to reshaping teachers' role in their interaction with students, which in turn resulted in pursuing higher levels of academic success.

CONCLUSION

The ongoing evolution of the education landscape requires ensuring equitable access and high-quality educational experiences for a diverse and expanding population. The preferred approach to surmount this challenge is the integration of digital technologies and blended learning (hybrid synchronous learning), which bridges the gap between on-site and remote education models. Such challenge was also stressed by the pandemic emergency which led teachers to adopt new forms of online teaching in order to maintain student engagement.

The study aims to investigate whether synchronous online environments have an impact on students' academic success within the context of academic education, integrating two theoretical frameworks: the Community of Inquiry model, with reference to its interdependent presences of teaching, cognitive and social, and the cognitive engagement framework focused on student's psychological investments and operationalized as cognitive processes of learning such as the applications of deep or shallow strategies during learning activities. To this end, an online self-report questionnaire was administered to 447 students from universities in southern Italy,.in order to test the best predictors of academic success. In general, the supposed associations were partially confirmed, ranging from moderate correlation between teaching presence and social presence, between deep learning strategies and academic achievement, and between teaching presence and both learning strategies. Moreover, academic success was predicted by teaching presence and both learning strategies. This finding is consistent with the outcomes of a study conducted by Zhang and colleagues (2016), where they emphasize the fundamental role of teaching presence: the teacher organizes and monitors online learning activities to help online students generate learning outcomes not only from the study of learning materials, but also from peer collaboration and interaction. Finally, the study showed no significant role of social presence in online synchronous environments.

The study findings highlight the need to reshape teacher roles, student interactions, materials and course design to best suit the specific learning environment and context, as demonstrated in the synchronous setting observed in this study and according to Karaaslan and colleagues (2018). They also provide insightful suggestions that could be implemented while planning and promoting synchronous online-based learning communities and activities that may enhance students' academic accomplishments from a more collaborative and constructivist standpoint.

It is essential to acknowledge two significant limitations of this study, which should be discussed. Firstly, the participants were recruited from universities situated in Southern Italy, where the synchronous online learning modality was adopted. This was achieved through a convenient sampling method, which in turn affects the generalisability of the findings. Secondly, there was a convergence of students towards course degrees in the Humanistic and Educational areas. This may have constrained the variability in students' digital literacy levels and familiarity with information and communication technologies, which are factors that may influence their learning experiences in general and, consequently, their academic achievements and satisfaction. It is recommended that further studies employ probability sampling methods to enhance the generalisability of the current results. This would enable a more comprehensive comparison of students' learning experiences and outcomes across a wider range of course degrees. Additionally, further studies could be designed to compare students' learning experiences and outcomes in face-to-face and synchronous modalities. Furthermore, it would be beneficial to investigate additional factors that may impact student academic performance in synchronous online learning environments, and the overall educational experience as conceptualised by the CoI framework in terms of teaching presence, cognitive presence and social presence. These factors include the physical learning environment (Dinh, 2023), the use of specific technologies – i.e., augmented reality (AR), virtual reality (VR) simulations, etc. – (Parga et al., 2019), and learners' digital literacy (Getenet et al., 2024).

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