Heliyon 9 (2023) e15803

Contents lists available at ScienceDirect

Heliyon

journal homepage: www.cell.com/heliyon

Research article

Modelling the role of learner presence within the community of inquiry framework to determine online course satisfaction in distance education

Justice Kofi Armah [a], Brandford Bervell [a,b,*], Nana Osei Bonsu [c]

[a] Maths, Science & ICT, College of Distance Education, University of Cape Coast, Ghana
[b] Centre for Instructional Technology and Multimedia, Universiti Sains Malaysia, Malaysia
[c] Aburaman Senior High School, Abura-Dunkwa, Ghana

ARTICLE INFO

Keywords:
CoI
Learner presence
Teaching presence
Social presence
Cognitive presence
Online course satisfaction

ABSTRACT

This study sought to investigate the nuances in predictive relationships existing among teaching presence, cognitive presence and social presence as well as learner presence in the Community of Inquiry (CoI) framework towards online course satisfaction. The study is necessitated by the deficiency of current literature in providing information on the nuances in interaction among the three original presences and learner presence, prior to the final determination of online course satisfaction. Thus, the study adopted a survey design and collected data via a questionnaire from 347 postgraduate students on an online database course. Partial Least Squares Structural Equation Modelling was used to validate a definite model on the predictive relationships existing among teaching presence, cognitive presence, social presence, learner presence and online course satisfaction. Results from the structural model analysis proved a statistically significant predictive relationship between learner presence and the three other presences (i.e. cognitive presence, social presence and teaching presence). Other relationships established include social presence and cognitive presence; social presence and teaching presence. Finally, online course satisfaction was predicted by social presence and teaching presence. Based on the findings it was recommended that institutions that offer online courses should device concrete strategies that promote social presence and teaching presence since these variables are precursors to online course satisfaction. Finally, the design of online courses should be effective and learner-centred to attract the learner since learner presence determines all the other three 'presences' in online learning environment.

1. Introduction

With the recent Covid-19 global health crisis, the certainty of online learning has been more established in the formal education system worldwide. Consequently, during the global health crisis, online learning became very prominent [1]. Many schools in which the mode of delivery has been in-person, began to rethink the need to adopt digital technologies to support teaching and learning. Countries around the world, including third world countries, introduced or scaled up on the use of different mixes of internet-enabled technologies to rescue the disruption in education caused by the pandemic. For instance, the United Arab Emirate (UAE) activated its

* Corresponding author. Maths, Science & ICT, College of Distance Education, University of Cape Coast, Ghana.
E-mail address: b.bervell@ucc.edu.gh (B. Bervell).

https://doi.org/10.1016/j.heliyon.2023.e15803
Received 14 December 2022; Received in revised form 18 April 2023; Accepted 21 April 2023
Available online 27 April 2023

virtual learning systems within the first week of the crisis [2]. Even when the infection rate of the virus continued to drop, albeit slow in some countries, the changes it has caused to the education industry remain [3]. The use of e-learning and online learning continue to rise distinctively.

Several researchers agree that online learning enhances students' engagement and interaction in the learning space [4,5]. For Cho and Tobias [6], online learning promotes social interaction and facilitates understanding among students and teachers. They reiterated that students have equal opportunities to participate in and create collective knowledge by sharing and elaborating ideas in the online space. Current online community spaces and networks provide a wide range of applications that offer learners with dynamic information and content [7]. Rahayu [8] also argued that online spaces such as Microsoft Teams and Zoom provide just-in-time and flexible learning opportunities where lecturers and students collaborate on a given task through break-out rooms (group work) and merge in the main meeting to present their solutions in groups. A wide range of tools such as YouTube, Facebook, Poll, Google drive, and multiple screens are integrated into these systems to provide opportunities and choices for students to communicate and share ideas synchronously on a given task irrespective of their location. However, to ensure that learning occurs in the online space, an appropriate pedagogical design and proper exploitation of the digital tools are crucial [9].

One of the most widely used frameworks on online pedagogical designs for building an effective and engaging online space is the Community of Inquiry framework (CoI) by Ref. [10]. Over the years, the CoI framework has been adapted by various researchers to guide into the complexities of designing online instruction [9,11]. The philosophical foundation of the framework is the social constructivist approach for learning and teaching. Its primary principle is that educational experience is worthwhile when there is teacher presence, student presence and cognitive presence [7]. In the traditional campus setting, the physical presence of teacher and learner has been established as significant for cognitive presence and learning to occur [12]. Additionally, teaching presence (facilitator who provides the necessary guidance and support to learners), cognitive presence (how learners construct their meaning out of content and communication) and social presence (the we-feeling and interactions among learners and facilitators) have been argued to be equally effective in both face-to-face learning and online learning environments (if not even more effective in the latter) [12,13].

For Garrison, Anderson and Archer [10], stronger online learning communities of inquiry exist when interactions allow students to establish their social presence as real people with individual thoughts, feelings, and honor. This is supported by Ref. [14] who assert that CoI framework can provide a higher level of self-directed learning skills and enable effective human online interaction, a phenomenon that is perceived as unique to conventional or face-to-face classroom. The effect of CoI on students' learning in online spaces has been reported widely as positive. For instance Refs. [6,9], contend that the CoI framework fosters community building and is likely to instigate, sustain and support content-related communication because it enhances students' engagement and motivates learning. By the wider use and application of the framework, it has been shown that online and distance learning does not have to be an inferior educational experience (compared to face-to-face).

Many studies have established that the original elements of CoI relate to students' learning outcomes and satisfaction [5,15]. However, they focused on the correlations between these original CoI elements and students' achievement [6,16,17] without considering the role of learner presence within the online learning environment.

Even Kang, Liew, Kim and Park [18], whose study focused on the influence of learner presence of students' and their satisfaction and achievement, did not indicate learner presence as a predictive variable but rather as a reference of the proposed three presences [10]. This means that [18] treated learner presence just as the three original presences in the CoI framework. However, this is in sharp contradiction to how Shea and Bidjerano [19] defined learner presence and made it distinctive to the original three presences as a new inclusion within the CoI framework. In the same vein [19], examined self-efficacy and effort (self-regulation), which they termed as learner presence, and used it as a moderator between the social presence and cognitive presence; and between teaching and cognitive presence. However, this was a moderation effect and did not resonate with the original idea by the authors on how learner presence is a definite variable that related with the other three presences towards online learning satisfaction. This study combines the elements of self-regulation and self-efficacy into one definite variable termed as learner presence. Additionally, there was no evidence of a predictive effect between learner presence and the three other presences leading to online course satisfaction. As an additional gap, previous studies did not establish the nuances on the interrelationships among the four notable types of presences of learning towards final online learning satisfaction of first-time online students. Similarly, Garrison, Cleveland-Innes and Fung [20] who attempted a study on the causal relationships among the elements of the CoI, excluded learner presence and also did not verify causality or predictive relationships with t-statistics, f-squared statistics and confidence intervals. In their own words, Garrison et al. [20] stated that "further research is called for to explore the dynamic relationships among the presences across disciplines and institutions …" pg.1. This viewpoint of the authors [20] was re-echoed by Honig and Salmon [21] that further investigations on learner presence is required in CoI research. This necessitates a redefinition of a causal relationship model of the CoI elements with the inclusion of learner presence and validated through structural equation modelling. In effect, do these notable four types of presences predictively relate with and among themselves leading to the determination of online course satisfaction in distance education? There is a need to fill this chasm in the literature.

Accordingly, using the CoI framework, this study seeks to investigate the opinion of first-time online learners about their satisfaction in an online course. The focus was to investigate the nuances in predictive interaction terms among learner presence, teaching presence, social presence, cognitive presence, and online course satisfaction among first-time online learners on a postgraduate database course using a Community of Inquiry-Based Model of Online Course Satisfaction (CoI-MOCS), verifiable through structural equation modelling. Against this background, the current study seeks to provide answers to the following research questions.

1. What is the predictive effect of learner presence on teaching presence, social presence and cognitive presence?
2. What is the effect of learner presence, teaching presence, social presence and cognitive presence on online course satisfaction?

3. What is the most important type of presence in determining online course satisfaction?
4. What is the total variance explained by the CoI-MOCS formulated in this study on online course satisfaction?

2. Literature review

2.1. Theoretical background

Drawn from Dewey's principles of learning, CoI is consistent with constructivist strategies on course design and learning in higher education [22]. Swan, Garrison and Richardson [23] argue that community and inquiry are the core of the CoI framework. They explained 'community' as the cognitive or a sense of connections between learners in separate geographical settings. Further, Wang [24] emphasized that 'community' is the individual's sense of belonging to and sharing in the faith of the group through the commitment of being together as a group. Community can emanate from the shared knowledge among learners in a learning space [25]. This occurs when there is the flow of information, community support, commitment to achieving the group goals, collaboration, and satisfaction about the group efforts by the members of the group [26]. Therefore, within the online learning environment, the learner's development depends on three interconnected elements: teaching presence, social presence, and cognitive presence [4,5]. Presence in this context refers to learners' "sense of active participation" in the learning process with emphasis on learner's knowledge creation and involvement through various forms of digital communication space [27].

2.2. Teaching presence

Teaching presence (TP) refers to learner interaction with teachers or anyone who facilitates learning to create and maintain a sense of community and engagement within the learning environment, although the teacher will have the primary responsibility [10]. Teachers establish teaching presence through learning design and organization, facilitating learning, and directing learners to participate in collaborative inquiries to ensure learner experiences. In the online learning environment, the teacher designs the instruction. This involves choosing the learning materials and digital tools for interaction, setting due dates for assessment tasks, and creating learning activities that allow students to effectively use the learning resources and tools. Koseoglu and Koutropoulos [28] add that, teaching presence includes the support and guidance and the teacher's ability to create and maintain a relationship with learners. In addition to course design, teachers need to facilitate, scaffold and direct [29]. In effect, teaching presence sets the pace for learning and ends the learning activities and interaction [9,30]. According to Jansson, Hrastinski, Stenbom and Enoksson [31], during course delivery, students can take roles of facilitators and demonstrators for other students. Several studies suggest teaching presence in the learning environment to encourage learner participation and engagement [32,33].

2.3. Social presence

Social presence (SP) denotes the social relationship within the community. The concept was first coined by Short, Williams and Christie [34] who defined social presence as "the degree of salience of the other person in the interaction and the consequent salience of the interpersonal relationships" (p. 65). For Garrison et al. [10], social presence is the individual's ability to project themselves as real people. Social presence has identifiers which are emotional expression, open communication, and group cohesion [10]. In the online learning environment, teachers are encouraged to help students familiarise themselves with the learning environment in order to socialise [29]. This is possible through video introduction, exchange of welcome messages, encouraging students to update their profile in the learning environment, setting online rules or netiquette, encouraging student participation in a critical debate, and connecting with students through group journals [35].

2.4. Cognitive presence

Cognitive presence (CP) is also known as the developmental model of the CoI framework or the physical inquiry model [29]. The authors continued that CP is the extent to which learners can "construct and confirm meaning through sustained communication" (p. 89) or reflection and discourse, as suggested by Ref. [29]. Garrison et al. [10] identified four phases of the cognitive presence that are used as indicators for measuring cognitive presence: triggering event, exploration, integration, and resolution. They explained that there should be a *triggering* event where learners recognise a problem and become puzzled by the given task or question. Individual learners explore different sources and use social exploration or discuss the ideas gathered by other group members to solve the ambiguities in the task. The learners then evaluate and integrate the ideas generated to complete the given task. At the resolution stage, learners apply the new knowledge created, into new situations. This allows the learner to deal with content and activities that will enable them to dive deeper into the subject matter or spark their intellectual curiosity about the subject [10]. To ensure cognitive presence, instructors must create an enabling environment for civil discourse, facilitate critical discussion and analyse other perspectives related to the subject-matter, encourage independent learning, allow learners to construct their own questions, answer questions, share their insights, encourage students to make connections between theory and practice, and facilitate reflection [29]. The teacher must also encourage student-led discussions, provide various resources, group or individual reflection, use peer-review assessment, provide different tasks or activities for students to pick from, and encourage multiple perspectives and dialogue.

2.5. Learner presence

Shea and Bidjerano [19] proposed a fourth construct called learner presence (LP) into the original CoI framework. They considered that the CoI framework had little focus on the student's role, involvement, and experience in the online learning environment [19,36]. Learner presence which is also associated with the concept of self-efficacy, is defined as an individual's beliefs in their "capabilities to organise and execute courses of action required to attain designated types of performance". Self-efficacy is widely researched and has been found to positively impact individuals' job satisfaction and academic success. The concept focuses more on self-belief rather than actual abilities. Shea and Bidjerano [19] also added that students who feel that they can be successful in an online course find the course worthwhile.

Learner presence is linked with Knowles [37] assumption of self-regulated learning [36]. In their study, Shea and Bidjerano [19] identified that learners attempt to make meaning of the task given them within groups. They break down complex tasks among themselves, manage their own time, set goals to complete group projects, and regulate the learning environment. This shows learner-self and co-regulation. In other words, the degree to which students in the digital learning environment are metacognitively, motivationally, and behaviorally active participants in the learning process. Learner presence can therefore be defined as learner use of self-regulated elements such as "goal setting, strategy selection and personal monitoring of effectiveness" [36 p. 155]. This renders learner presence very important and goes beyond mere self-regulation and self-efficacy beliefs but actual active demonstration of their beliefs and self-regulation in online learning.

2.6. Online course satisfaction

Satisfaction, according to Weerasinghe and Fernando [38], is a "short-term attitude resulting from an evaluation of students' educational experiences, service and facilities" (p. 534). According to Wright and O'Neill [39], the learners' experiences are provided by the instructor. Instructors are expected to manipulate the online learning environment to influence students' cognition experiences [40]. As co-producers of knowledge, students and instructors must also identify with the learning community, communicate and project themselves socially and emotionally to ensure effective learning [10]. In this context, therefore, we define students' satisfaction as the relatively favourable response of students about their facilitating experiences, social experiences and cognitive experiences in the online course. It is a state of feeling when facilitators can meet students' experiences and expectations through the design, facilitation, and direction of cognitive and social processes for personally meaningful and educationally worthwhile learning outcomes [10].

3. Hypotheses development and model formulation

3.1. Relationship among the elements of CoI

The CoI framework suggests that teaching, cognitive and social presences are central to a successful online educational experience. In online learning, the teacher's presence is essential to direct the learning process [41]. Thus, teaching presence focuses on the teaching principle of designing, facilitating and executing instruction according to the instructional setting and goals of the learning [9, 20, 29]. Social presence, on the other hand, enables students to develop problem solving and leadership skills. For example, students can assume the role of instructors by leading an online class discussion [42]. This is echoed by Ngubane-Mokiwa and Khoza [41] who alluded that, students generally seem to learn more when they observe or partake in peer interaction. This helps them share their views, debate and receive support from fellow students.

Additionally, cognitive presence is concerned with the occurrence of learning and knowledge construction through interaction [41]. Of these three presences, Garrison et al. [10] suggest that cognitive presence is the most important. Law and Geng [43] found that teaching presence has a direct positive influence on cognitive and social presences. This result was re-echoed by Skrypnyk, Joksimović and Kovanović [44] who indicated that teaching presence influences cognitive presence and facilitation of social interaction in a community of learners.

Garrison [45] suggests that the learning experience must accommodate the interests of individuals and groups through collaboration between individuals so that the students will work together and take responsibility for constructing their knowledge into a problematic situation. Thus, paying attention to learners' roles in the digital learning environment allows learners to interact and explore their cognitive skills [46,47]. Shea and Bidjerano [19] identified that a positive relationship exists among learner presence and the elements of the original CoI framework. Caskurlu, Maeda and Richardson [14] also found a significant variation among students for perceived learning and satisfaction. Learner presence, as explained by Caskurlu et al. [14], constitute design and organization, facilitation, and direction of instruction. This definition seems to be geared towards teaching presence and differs from Ref. [19] explanation of a learning experience, which refers to elements such as self-efficacy as well as other cognitive, behavioral, and motivational constructs supportive of online learner self-regulation. Little research has been conducted on the relationship between learner presence (as explained in its entirety by Shea and Bidjerano [19]), and teaching presence, social presence, as well as cognitive presence.

One of the primary attractions of online learning is the ability to provide social presence. Within the virtual learning environment, students can use different communication tools such as forums, chats, video conferencing tools etc. To share ideas. This enables students to experience each other's feelings, thoughts and emotions through social presence. Social presence is identified to influence students' online course satisfaction [41]. However, learners must be online in order for facilitators to group them into small

communities of learning for interaction and communication to occur. This means that without the presence of learners online, it becomes difficult for online learning communities to be built. Hence learner presence will propel or induce social interactivity among online learners. This makes learner presence a possible precursor for social presence to occur.

Online learning has some similarities with face-to-face learning [48–50]. Therefore, as first-time online learners experience virtual classroom, we suppose that their experiences and perceptions for digital environment can aptly be revealed through the CoI framework.

3.2. Elements of CoI and online course satisfaction

Positive relationships between the elements of CoI and course satisfaction were reported in several empirical studies. For example, Richardson and Swan [51] found a strong correlation between perceived social presence and student satisfaction and perceived learning. Furthermore, several studies have identified the elements of CoI as important factors predicting student's satisfaction [10, 52–54].

Choy and Quek [55] examined the relationships among elements of the CoI framework and course satisfaction. The results revealed strong correlation between online course *satisfaction* and teaching element ($r = .38$, $p < 0.01$), social element ($r = 0.55$, $p < 0.01$), and cognitive element ($r = 0.59$, $p < 0.01$). These findings confirm Joo, Lim and Kim [56] assertion that cognitive presence has a greater influence on students' online satisfaction than social presence. Several other studies have also shown that cognitive presence significantly predicts learners' satisfaction compared with teaching presence and social presence [18,23].

In addition, other studies have also documented a strong correlation between teaching presence and student satisfaction and perceived learning in online courses [56,57]. This shows that, for example, the teacher's caring persona and timely supportive feedback in the learning environment can influence students' satisfaction and work ethics [58]. It also shows that the central role teachers play in the online learning environment positively impacts the students' satisfaction with online course [59].

For Armellini and De Stefani [54], social presence is the highest predictor of learning satisfaction among the presences and suggested social presence ought to be given more prominence in the CoI framework. This assertion of Armellini and De Stefani [54] is confirmed by Stermer [60], who identified that students rank social presence higher in terms of academic advising and completion of an online course which indirectly result in students' satisfaction of an online course.

Online course satisfaction is one of the most critical factors determining the quality of online instruction [61,62]. As such, the relationship between learner presence and course satisfaction cannot be ignored. For instance, So and Brush [63] indicated that student learner presence has a statistically positive relationship with course satisfaction. On the other hand, Richardson et al. [5] identified considerable variation among correlations (86.7% for satisfaction and 92.8% for perceived learning). These indicate that learner presence can most likely have high learning satisfaction. In support of [5,63], Kang et al. [18] posit that learner presence could be powerful to predict students' satisfaction.

In sum, these previous studies indicated a correlation between students' satisfaction with online course design and the CoI framework. However, there are variations in students' satisfaction based on the elements of CoI and this needs to be established. Hence, with reference to reviewed literature on the relationships within the elements of the CoI framework, we postulate the following hypotheses.

H1. There is a predictive relationship between learner presence and first-time online learners' teaching presence.

H2. There is a predictive relationship between learner presence and first-time online learners' cognitive presence.

H3. There is a predictive relationship between learner presence and first-time online learners' social presence.

H4. There is a predictive relationship between social presence and first-time online learners' cognitive presence.

H5. There is a predictive relationship between social presence and first-time online learners' teaching presence.

H6. Teaching presence predicts first-time online learners' course satisfaction

H7. Cognitive presence predicts first-time online learners' course satisfaction

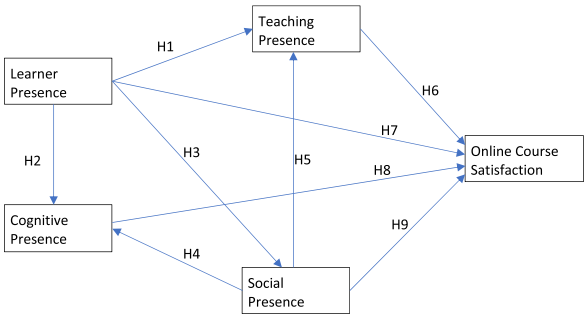

Fig. 1. Community of inquiry-based model of online course satisfaction (COI-MOCS).

H8. Social presence predicts first-time online learners' course satisfaction

H9. Learner presence predicts first-time online learners' course satisfaction

Based on the hypotheses formulated, the study proposed the model in Fig. 1 below.

4. Research methodology

4.1. Research design

This quantitative research adopted the survey design to examine whether students perceived community of inquiry and perceived learning correlate among first-time online learners and individually predict their online course satisfaction. As it was hypothesized in the proposed model, the predictor variables would significantly explain the variances in online course satisfaction among first-time online learners.

4.2. Research context

The institution selected for this study is a dual-mode public university whose distance education sector runs face-to-face every weekend. The distance education unit has four departments: education, business, arts and social science; mathematics and science programs. A population of 2237 students are enrolled in the graduate program, and most of them are between 28 and 33 years old. All courses are provided via face-to-face with disparate use of technology such as PowerPoint and projector. During the covid 19 pandemic, learners were required to follow a fixed schedule that rotates between optional traditional classroom lectures supplemented with occasional video conferencing. However, to pilot the institutional learning management system, 423 students offering ICT related courses in their master's in education programs were required to go fully online due to the nature of their course and familiarity with technology.

4.3. Course design strategies for the first-time online learners

The researchers utilised Moodle, which was the de facto learning management system of the University of Cape Coast for teaching and learning online. The course content, instructions, learning activities and course resources were uploaded on the LMS platform to be accessed by postgraduate students to foster teaching presence. The LMS was also used to create profiles that were viewed by students and teachers. Other external tools such as Zoom, Flipgrid and Padlet were used sparingly. Flipgrid, for instance, was used for students' introduction. Each student was also asked to create a minute parody of any event using the Flipgrid. This unleashed the students' voice when they replied to each other and generated a lot of emotions. The Padlet was used by students to post external resources which they found interesting and relating to the course content. The Padlet was basically used to curate ideas. These tools complemented the discussion forums to foster cognitive and social presence in the course [64]. The CoI elements, strategies and tools used in the course design and delivery are shown in appendix 1.

4.4. Participants

The study adopted the purposive sampling technique. The 347 out of the 423 students' population who studied fully online, completed and submitted the online survey. The majority (81%) of the participants were predominantly male students, with few (19%) female students. The age group of the participants also ranged from 26 to 56 years. There were 61.5% first-year students and 38.5% final-year students. The participants were teachers 72%, trainers 16% and self-employed 12%. These students were geographically dispersed and accessed the LMS in the comfort of their homes.

4.5. Instrument and data collection

The survey instrument was administered to students to gather data using google forms. The research instrument consisted of 56 items on a five-point Likert-type scale. The instrument captured the student's satisfaction, teaching, social, cognitive and learner presence. The items for the teaching, social and cognitive presence were based on a 34-item CoI survey developed by Arbaugh [65]. Again, 22 items on learner presence items were drawn from the earlier scale used by Shea and Bidjerano [19]. Finally, the course satisfaction items were adapted from Wang [66]. This online survey also captured students' demographic data. This research was approved by the Institutional Review Board (IRB) with reference number UCCIRB/EXT/2020 with human subjects. This approval includes language related to consent to participate and consent for publication.

All respondents signed an informed consent statement to agree to be voluntary respondents for the study without any coercion and were free to opt out at will. In order to understand the students' satisfaction with the online course, the survey was completed by students after their end-of-semester examination. Data collected were inputted in SPSS 21 and exported into SmartPLS version 3.3 for measurement and structural model analyses based on Partial Least Squares Structural Equation Modelling approach.

5. Analysis and findings

5.1. Model evaluation

For model evaluation, Hair, Sarstedt, Ringle and Gudergan [67] recommended a two-stage approach. These include measurement and structural model analyses. In terms of the measurement model, parameter estimations for internal consistency (loadings, Cronbach's alpha reliability, composite reliability, rhoA, and average variance extracted, discriminant validity and multicollinearity) are determined. The second stage which is based on the structural model comprises analyses such as paths significance, f-squared, confidence intervals, coefficient of determination, Q-squared and importance-performance map analysis.

6. Measurement model analyses

6.1. Internal consistency

The parameters for internal consistency in terms of loadings, Cronbach's alpha reliability, composite reliability, rhoA, and average variance extracted, the PLS algorithm for exploratory factor analysis was run and this is depicted by Fig. 2. Based on the item loadings, some of the items for example LP 1, 2, 11, 12; SF 1; TP 4, 9; CP 1, 5; SP 3 etc. were deleted in order obtain higher loadings more than 0.5 as recommended by Hair, Hult, Ringle and Sarstedt [68] to ensure better reliability estimates and content validity. After the deletion of the items that loaded below the 0.5 threshold, a second PLS algorithm for confirmatory factor analysis was run and the pictorial image is shown by Fig. 3 and estimates recorded by Table 1.

From Table 1, all the loadings across the various constructs were higher than the 0.5 minimum criterion. This implies that all the items sufficiently determined their associated constructs. Similarly, Cronbach's Alpha values for all the constructs were higher than the suggested 0.7 minimum threshold [69,70]. Composite reliability which is preferred to Cronbach's Alpha confirmed the reliability of the items of all the constructs with values exceeding the minimum threshold of 0.7. To further prove the reliability of the measurement model, the rho_A values were also examined. From the table, all values for rho_A from the various variables were higher than the 0.7

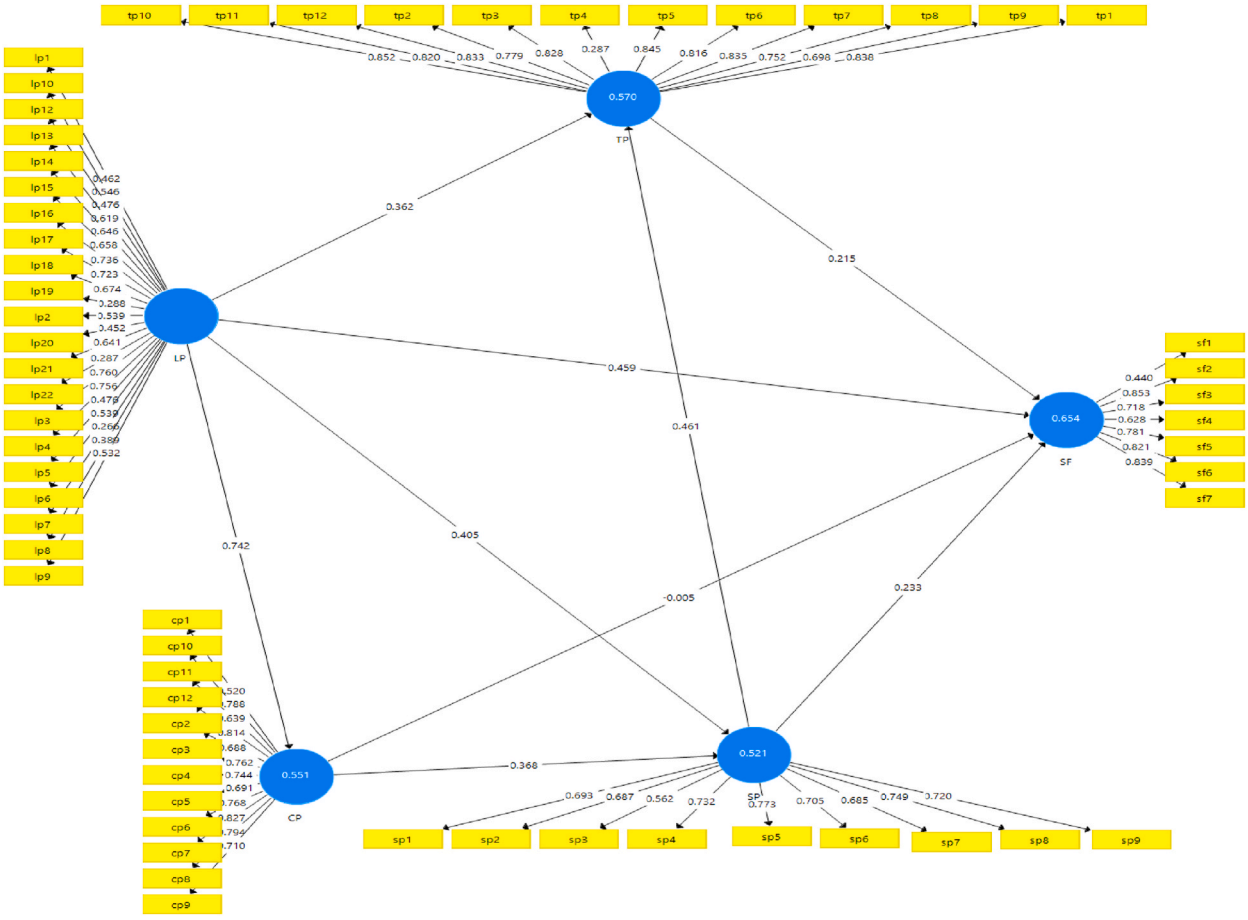

Fig. 2. PLS algorithm for exploratory factor analysis.

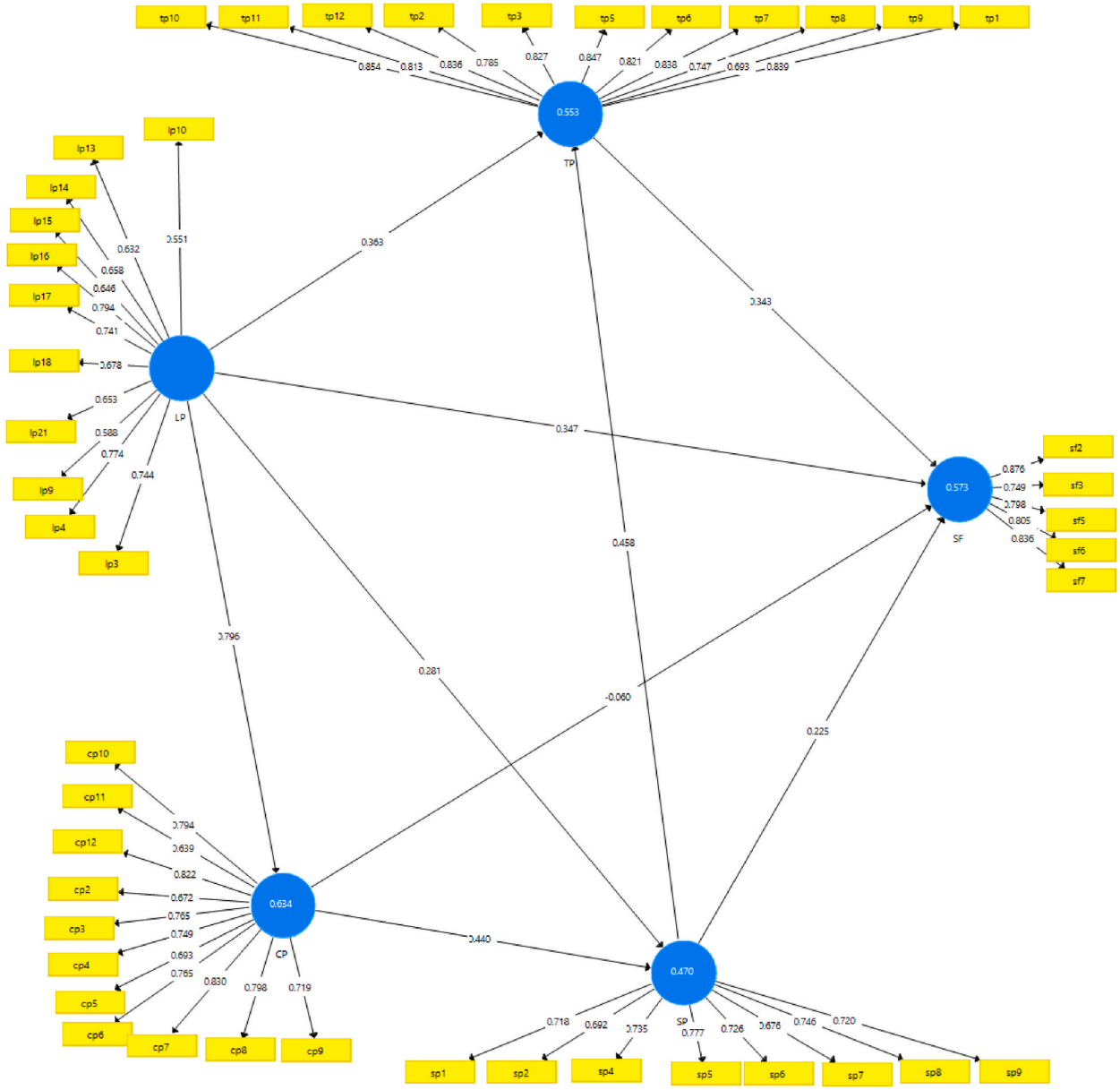

Fig. 3. Pls algorithm for CFA

criterion as suggested by Hair et al. [67]. 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 exceed 0.5. From the table, AVE values ranged from 0.500 to 0.679, satisfying the requirement.

7. Discriminant validity

Within a model, both exogeneous and endogenous variables should be distinct from each other and represent a unique construct measurement [12]. This means that for any two constructs, they should not be highly correlated [67]. To determine discriminant validity, the Heterotrait-Monotrait-Ratio (HTMT) is recommended not to exceed a value of 0.9 [67,71,72]. Table 2 displays the various HTMT values across the constructs.

From Table 2, all the HTMT values are lower than 0.9 with only one value which was 0.860 being the highest. The HTMT values obtained for the constructs means that each construct within the model was sufficiently unique and measured a particular attribute different from all the others. Thus, discriminant validity was achieved for the measurement model.

Table 1
Internal consistency measures.

Variables	Item Loadings	Cronbach's Alpha	rho_A	Composite Reliability	Average Variance Extracted (AVE)
CP10	0.794	0.923	0.930	0.934	0.565
CP11	0.639				
CP12	0.822				
CP2	0.672				
CP3	0.765				
CP4	0.749				
CP5	0.693				
CP6	0.765				
CP7	0.830				
CP8	0.798				
CP9	0.719				
LP10	0.551	0.884	0.893	0.904	0.500
LP13	0.632				
LP14	0.658				
LP15	0.646				
LP16	0.794				
LP17	0.741				
LP18	0.678				
LP21	0.653				
LP3	0.744				
LP4	0.774				
LP9	0.588				
SF2	0.876	0.873	0.886	0.907	0.663
SF3	0.749				
SF5	0.798				
SF6	0.805				
SF7	0.836				
SP1	0.718	0.871	0.875	0.898	0.525
SP2	0.692				
SP4	0.735				
SP5	0.777				
SP6	0.726				
SP7	0.676				
SP8	0.746				
SP9	0.720				
TP10	0.854	0.947	0.950	0.955	0.657
TP11	0.813				
TP12	0.836				
TP2	0.785				
TP3	0.827				
TP5	0.847				
TP6	0.821				
TP7	0.838				
TP8	0.747				
TP9	0.693				
TP1	0.839				

Table 2
Heterotrait-monotrait values.

Variables	CP	LP	SF	SP	TP
CP	0				
LP	0.860	0			
SF	0.631	0.727	0		
SP	0.708	0.698	0.710	0	
TP	0.707	0.702	0.736	0.726	0

8. Multicollinearity

The presence of multicollinearity (whether lateral or vertical) renders hypothesized paths in a model to be susceptible to both type 1 & 2 errors when bootstrapping for significance. This creates unreliability in results obtained from the bootstrapping sequence. Hence, to detect and solve for multicollinearity, Kock [73] suggests a full collinearity statistic based on the variance inflation factors (VIF) values [12]. The author provides a minimum threshold for VIF values not more than 3.3.

From Table 3, all the VIF values across the constructs in the model, ranged from a minimum of 1.000 to a maximum of 3.216. This means that all the VIF values were below the recommended 3.3 cut off point. Based on the VIF values, it is concluded that the estimated

Table 3
Variance inflation values.

Variables	CP	LP	SF	SP	TP
CP			3.216	2.733	
LP	1.000		2.997	2.733	1.664
SF					
SP			2.254		1.664
TP			2.320		

measurement model was free from multicollinearity.

9. Structural model analysis

In order to test the hypothesized paths within the estimated model for significance or otherwise, a structural model analysis is required. This is based on a bootstrapping sequence of 5000 resamples within the PLS-SEM software. The results of the bootstrapping procedure are depicted by Fig. 4 and Table 4.

Table 4 provides the total summary of all the values needed to provide and the results of the hypothesized paths. From the table, the predictors of online course satisfaction were social presence ($\beta = 0.225$, $t = 2.528$, $p = 0.018$, $p < 0.05$) and teaching presence ($\beta = 0.322$, $t = 2.895$, $p = 0.000$, $p < 0.001$). The validity of the significant predictions by teaching presence and social presence is proven

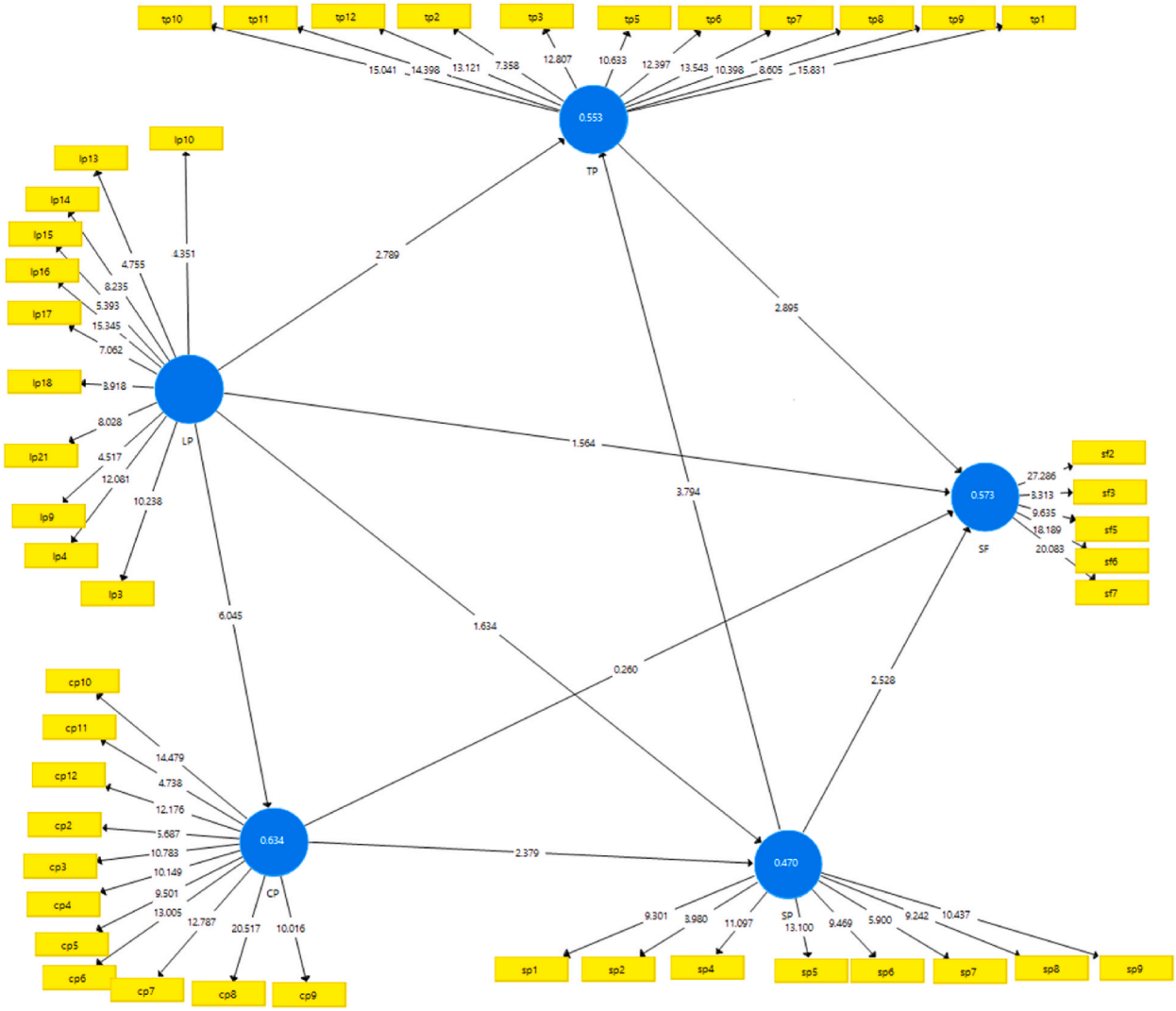

Fig. 4. PLS-SEM bootstrap image.

Table 4
PLS-SEM paths' significance results.

Hypothesized Paths	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics	P Values	Decision	f-squared values	Confidence Interval at 95%	
							LB	UB
CP - > SF	0.008	0.225	0.260	0.494	NS	0.000	−0.361	0.345
LP - > CP	0.621	0.134	6.045	0.000**	S	0.760	0.383	0.816
LP - > SF	0.340	0.231	1.564	0.055	NS	0.078	−0.058	0.705
LP - > SP	0.316	0.170	2.634	0.008**	S	0.630	0.203	0.278
SP - > CP	0.282	0.140	2.379	0.005**	S	0.246	0.073	0.520
SP - > SF	0.225	0.148	2.528	0.018*	S	0.354	0.030	0.424
SP - > TP	0.710	0.053	3.794	0.000**	S	0.891	0.621	0.795
LP - > TP	0.675	0.067	2.789	0.000**	S	0.767	0.565	0.779
TP - > SF	0.322	0.176	2.895	0.000**	S	0.802	0.062	0.630

Significant at **$p \leq 0.001$; *$p \leq 0.05$. S=Supported/Accepted; NS:Not Supported/Rejected.

by the one-dimensionality of their confidence intervals at 95% with lower and upper boundaries of 0.062–0.630 and 0.030 to 0.424 respectively. This is an indication that the significant predictions were not spurious. However, both cognitive presence and learner presence were not significant in determining students' online course satisfaction ($\beta = 0.008$, $t = 0.260$, $p = 0.494$, $p > 0.05$) and ($\beta = 0.340$, $t = 1.564$, $p = 0.055$, $p > 0.05$) respectively. This non-significance was also proven to be valid at a confidence interval of 95% with a multi-dimension nature of −0.361 to 0.345 and −0.058 to 0.705 respectively.

It is important to note from Table 4 that both social presence ($\beta = 0.282$, $t = 2.379$, $p = 0.005$, $p < 0.05$) and learner presence ($\beta = 0.621$, $t = 6.045$, $p = 0.000$, $p < 0.01$) strongly determined cognitive presence with a unidimensional nature of their confidence intervals of 0.073–0.520 and 0.383 to 0.816 at 95% confidence proven the validity of the prediction.

Finally, there was also a strong predictive relationship between social presence and teaching presence ($\beta = 0.710$, $t = 3.794$, $p = 0.000$, $p < 0.01$) and that of teaching presence and learner presence ($\beta = 0.675$, $t = 2.789$, $p = 0.000$, $p < 0.01$). Finally, learner presence determined social presence ($\beta = 0.316$, $t = 2.634$, $p = 0.008$, $p < 0.01$) Again, the above significance was validated by a margin of 5% error in confidence with a one-dimensionality in their confidence intervals.

Ultimately, an f squared (f^2) value range of 0.246–0.891 across all the significant paths, indicate a predictive magnitude of medium to large effects. In all, the results obtained from the bootstrap sequence supported six hypotheses out of the eight hypotheses raised in this study.

10. Coefficient of determination (R^2)

Coefficient of determination measures the amount of variance in the endogenous variable explained by the combination of all other exogenous variables in the estimated model [74]. It is also an indicator that further validates the estimated model based on the total variance explained by its main endogenous variable. Table 5 provide records of all the variances explained within the outcome variables.

From Table 5, the variance explained by the model based on the main exogenous variable (satisfaction in online course) is 57.3%. This is the total variance explained by the estimated model (COI-MOCS) in this study. This variance is high enough to validate the estimated model for this study according to the thresholds provided by Hair et al. [67] and Kline [71].

Table 5 provides other predictions within the model that recorded total variances ranging from 47% to 63.4%. All the R^2 values obtained from the predictions are sufficient enough to validate the model.

11. Q-squared (Q^2) validation of paths significance

Another pertinent indicator of validity of the significant paths in the model is the predictive relevance denoted by Q^2 [12]. In order to assess the predictive relevance of the significant paths, the blindfolding procedure for reflective models was used [67]. According to Hair et al. [68], predictive relevance values of 0.02, 0.15 and 0.35, represent small, medium and high relevance [12]. Predictive relevance values obtained from the blindfolding process are provided in Table 6.

From Table 6, the Q^2 values were very high, ranging from 0.356 to 0.568, indicating high relevance in all the predictions in the estimated model within this study.

Table 5
R-squared values.

Variables	R Square	R Square Adjusted
CP	0.634	0.627
SP	0.470	0.448
SF	0.573	0.536
TP	0.553	0.534

Table 6
Q-squared (Q^2) values.

Variables	SSO	SSE	Q^2 (=1-SSE/SSO)
CP	510.000	276.797	0.457
LP	561.000	361.204	0.356
SF	255.000	131.702	0.484
SP	408.000	255.029	0.375
TP	510.000	220.370	0.568

12. Importance-performance-map analysis (IPMA)

The Importance Performance Map Analysis (IPMA) provides important information on which exogenous is either highly performing or very important in determining the main endogenous variable [68,74]. This is estimated through the IPMA process in PLS-SEM [75]. The result of this process is in Table 7.

From Table 7, the two key predictors of online course satisfaction recorded performances of 65.058 for social presence and 77.620 for teacher presence. This indicates that teaching presence performed better in predicting online course satisfaction than social presence. However, in terms of importance of both exogenous variables in determining students' online course satisfaction, social presence (0.734) was more important than teaching presence (0.566), confirming the results indicated by the IPMA graph. These results have crucial implications on policy and practice in online course delivery in distance education.

13. Discussion on findings

To begin with, teaching presence determined learners' online course satisfaction. The findings suggested that the central role teachers play in an online learning environment is important to students' online learning. This was further confirmed by the importance-performance map analysis (IPMA) that showed teaching presence as the highly performing type of presence in determining online course satisfaction. However, it was not the most important type of presence as indicated by the same IPMA result. This finding corroborates with that of Armellini [54] who rather indicated social presence as the most important predictor of online learning satisfaction. We uphold the findings on the important predictive effect of teaching presence within this study on the basis that, when the teacher who is the frontliner in the teaching and learning process is able to establish scholarly leadership through coherent content presentation, sharing of external resources, identifying learning activities, providing clear directions and outcomes, engaging students in a meaningful dialogue, acknowledging learner contribution, encouraging students and providing feedback that meet their expectations and feelings, learners are more likely to be satisfied with the online course [30,51,76]. Students have little sense of direction, therefore, as suggested by Ladyshewsky [59] and Oyarzun et al. [58], the care and support provided by teachers in the virtual learning environment is what makes the learner satisfied about the online course but not the mere presence of the learner per se. This explains why learner presence did not directly determine students' online course satisfaction.

Similarly, social presence significantly predicted learners' online course satisfaction. This implies that when first time online learners are able to identify with a safe learning community devoid of fear and criticism, they are able to express themselves emotionally and socially to ensure effective learning [10]. The finding confirms Stermer [60] and Richardson and Swan [51] who claimed that students value meaningful dialogue with peers and teachers. It also supports the assertion that social presence in an online environment foster online course satisfaction [60]. This is more so when students spend a lot of time with their peers and teachers and there is high level of we-feeling and collaboration in the learning environment [60]. Undoubtedly, within this study, the IPMA results confirmed social presence as the most important factor in determining first-time online learners' course satisfaction.

Another important finding is that social presence significantly determined cognitive presence. Thus, as the teacher put the learners into communities, he fosters peer interaction and engagement. Within the communities that learners engage in elaborative collaboration which moves students from assisted performance to deauthorization. This is because within the communities, students can assume the role of teachers (more knowledgeable other, MKO) by leading group discussions and supporting each other [42,54]. As rightly indicated by Ngubane-Mokiwa and Khoza [41] students seem to learn more when they observe or partake in peer interaction. They can share their views, debate, and receive support from fellow students. The result also conforms with the findings of Rolim et al. [77] who proved that social presence statistically significantly affects all the indicators of cognitive presence thus triggering events, exploration and integration in the development of students' social and critical thinking.

The study also revealed that learner presence significantly predicted cognitive presence in an online course. This relationship is novel and means that with high level of learner presence, learners are more likely to possess a corresponding high level of knowledge

Table 7
IPMA results for satisfaction in online learning (SF) by predictor and non-predictor variables.

Variables	Performance on SF	Importance on SF
CP	68.089	−0.004
LP	71.306	0.333
SP	65.058	0.734
TP	77.620	0.566

construction and confirmation. The result is consistent with [19,45,47] as well as [14]. This concludes that the learner presence – thus learner's self-beliefs that they will be successful in the online course and self-regulation in the online course, in other words their attempts to manage their own time, set goals to complete group projects and regulate the learning environment as suggested by Shea and Bidjerano [19] are significant to envisage the student's cognitive presence. The finding confirms that students have a role in the online learning environment. The absence of the learner is the absence of learning (cognitive presence), hence, the inclusion of learner presence in the CoI framework as recommended by Shea and Bidjerano [19] is justified in this study.

Another contributing factor identified is social presence and cognitive presence of first-time online learners. Social presence significantly predicted cognitive presence. Therefore, students with high level of social presence are more likely to construct knowledge and skills and build understanding in an online course. As identified by Ngubane-Mokiwa and Khoza [41], it is when the learners are online that they can participate or interact with colleagues and content meaningfully. Students online can receive support from peers and teachers, engage in group reflection and participate in critical discussion. This finding is in congruence with Rolim et al. [77] assertion that social presence is more connected with cognitive presence.

Subsequently, social presence also significantly predicted teaching presence. Generally teaching presence has been found to influence social presence [43,44]. This is rightly so because, in the beginning of online course, teachers normally invest a lot of time in establishing their presence through the learning designing, welcome message, course orientation videos and responding to emails. On the other hand, students are likely to participate in the online course if they receive timely feedback and support from teachers. The findings suggest that high sense of community – communication, group cohesion that develop among the actors is as a result of the teacher's effort to guide or to keep the learners to the learning objective(s), tasks/activities, redirecting learners to external resources, resolving conflicts, providing support or calling the students attention to the academic discourse when they are digressing. Hence course facilitation and direction become more meaningful and interesting when there is a high student's participation in the online course.

It is worth noting that another novelty within the study was learner presence significantly predicting teaching presence. Thus, the design and facilitation of the online course sustains the presence of learning. Actual presence of the teacher sustains the learner. Every online learning should be initiated by the teacher through for example stating clear learning outcomes, ensuring coherent content presentation, conducting learning activities, ensuring participation, providing feedback and support [30]. This is because learners by themselves would not know what to do in the seemingly wide world of the web. Successfully performing these roles and more—enhances learner presence and gives the learner a good reason to be present in an online learning environment, since there is a facilitator to guide, direct and offer support when and where necessary.

Finally, cognitive presence did not significantly predict learner satisfaction. This provides the meaning that learner engagement with learning material alone does not offer satisfaction. They require further explanation, expatiation and understanding of the materials they are engaging with. They also require the clear decisions on learning goals and expectations. Learners need encouragement to participate and directions on how to interact with the content and peers and also confirm their thinking. It is when the teacher comes in to offer such support that the learner become satisfied in the online learning environment and not the mere presence of the learner or engagement with the learning materials per se.

14. Implications on theory

This study has sufficiently expanded the nuances in terms of interactions among the exogenous variables within the CoI framework by including learner presence within the verified model within this study. This further augments the importance of the CoI framework when it comes to online learning satisfaction.

The study has further proven that learner presence is a propeller for social presence, cognitive presence and teacher presence but not as a mere moderator as suggested earlier by the proponents of the CoI framework.

It is also important to include that establishing within this study, how the factors within the CoI framework predictively relate among themselves within the verified model is vital and provides sufficient insights into how the factors individually play important roles in determining the existence of the other and enforcing their final effect towards promoting online learning satisfaction.

The study has also established what factors are either important or have high performance within the CoI framework, when it comes to determining online learning satisfaction. These are necessary for theoretical and practical considerations.

15. Implications for practice

Social presence and teacher presence were the main predictors of online course satisfaction. This implies that, institutions employing online learning should motivate and encourage facilitators to be periodically present online to attend to students' questions and concerns. This can be done by officially coming up with time schedules for online meetings that will mandate facilitators to be present online and respond to students in terms of offering guidance, direction, promoting engagements etc. in order for students to feel satisfied in online courses. Additionally, institutions should offer sufficient training to facilitators on the techniques needed to foster and promote social interaction and collaboration among students in an online environment. The building of an online community provides a we-feeling (just like in the traditional classroom) among online learners.

Since learner presence and social presence are the two critical variables determining cognitive presence, strategies that drive learners to come online are necessary. It is only when learners are online that they can engage with the materials online and make meaning out of them. Furthermore, if facilitators are able to create an online social community, then, learners will be able to further engage with online learning materials through peer collaborative elaboration. The key focus of an online learning platform is for

learners to interact with subject content and materials required for a particular course of study. Through this, learners can come out with their views that are further clarified by both the facilitator and the more knowledgeable other (colleague) for better understanding.

Social presence will mean the presence of the facilitator creating students' online groupings, guiding academic discourse on materials read online and redirecting learners to the discussion on subject content when they veer off and get carried away with other irrelevant discussions. Thus, if facilitators are present online, it induces learners to also come online and in turn determine their onward social presence. This makes teacher presence an important component of the CoI framework that has influence on almost all the other variables (presences).

Finally, learner presence and cognitive presence did not determine students' online course satisfaction. This means that the mere appearance online and engagement with online materials are not enough to promote leaners satisfaction. There should rather be a teacher to welcome leaners, respond to their needs and guide them as well as engineering the learning community that will provide a friendly and social environment for the leaner to have interaction with other peers and feel belongingness within a wider online community where they share ideas and offer peer support in their academic discourse.

16. Limitations and recommendations for future work

The study did not include the modes of online interaction (student-student; student-teacher; student-content; teacher-teacher; content-content) in the model to adduce the nuances among interaction modes and the different 'presences' in the CoI framework. The study did not consider moderating effects of factors such as gender, age and course year level of students to ascertain any differences in the incidence of effects on the predictors of online course satisfaction. Also, the study used a single source data from a sample of students from just one masters' programme, which makes generalisation cautionable.

We therefore, suggest that future studies that provide a comprehensive model on the factors from both the CoI framework and that of the modes of interaction towards online learning satisfaction will be very interesting. Future studies could include moderating effects of gender, age and level of study on the predictors of online course satisfaction based on the CoI framework presented in this study to prove whether variations exist in terms of the former moderators on social presence and teacher presence in relation to online course satisfaction. Finally, future studies can consider a larger sample (big data) that covers all the masters' programmes that are offered on a blended mode in an institution of higher learning to validate the results from this study.

17. Conclusion

This study formulated and validated a CoI-MOCS that explained a variance of 57.2% in students' satisfaction of an online course in distance education. It has provided a novel contribution to literature on the CoI framework by establishing the relationships between learner presence and the three original types of presences in the CoI framework. Hence, the inclusion of learner presence provides a better understanding of its nuances with the other CoI elements towards course satisfaction in online learning environments. This suggests that there cannot be an effective learning framework without the learner being present as well. Additionally, the study revealed through an importance-performance map analysis that teaching presence is the most important factor in the CoI framework in determining learners' online course satisfaction. Thus, facilitators should be constantly present online (synchronously or asynchronously) to communicate instructions, and to create interactive and engaging learning experiences which serve as anchors to students' satisfaction in online learning.

Author contribution statement

Justice Kofi Armah: Brandford Bervell: Conceived and designed the experiments; Performed the experiments; Analyzed and interpreted the data; Contributed reagents, materials, analysis tools or data; Wrote the paper.

Nana Osei Bonsu: Performed the experiments; Contributed reagents, materials, analysis tools or data; Wrote the paper.

Data availability statement

Data will be made available on request.

Additional information

No additional information is available for this paper.

Availability of data and materials

The datasets generated during generation and/or analyzed during the current study are available from the corresponding author on reasonable request.

Funding

Not available.

Declaration of competing interest

None

Acknowledgements

We express our sincere gratitude to all the postgraduate distance students at the College of Distance Education, University of Cape Coast who served as respondents to the survey instrument.

Abbreviations

AVE	Average variance extracted
CoI	Community of Inquiry
CP	Cognitive Presence
CFA	Confirmatory factor analysis
HTMT	Heterotrait–Monotrait ratio
IPMA	Importance-Performance Map Analysis
LP	Learner Presence
PLS	Partial least squares
PLS-SEM	Partial least squares structural equation modelling
SP	Social Presence
SEM	Structural equation modelling
UAE	United Arab Emirate
VIF	Variance inflation factor

Appendix 1. CoI of inquiry elements, strategies and tools used in the course design and delivery.

Presence	Elements	Strategies used	Online tools
Social Presence	Open Communication	Welcome Message. Introduction - Students were encouraged to introduce themselves.,	Zoom Flipgrid and LMS
		Changing their profile pictures	LMS
		establishing netiquette guidelines,	LMS
		communicating course expectations	LMS
		Calling the names of student kindly	
	Group Cohesion	Collaborative activities	Wikis, Padlets, Google docs
		Small group interaction through video conference	Break out rooms in zoom
		Jig saw approach using Break out Rooms	Zoom
		Encouraging critical discussion.	
	Emotional expression	Ice breaking activity (e.g three work game)	LMS chats, Zoom, LMS
		Encouraging learners to talk about their expectations and aspiration, orientation how to navigate the LMS	
Cognitive Presence	Triggering Event	Presenting different task that are aligned with learning outcomes and support technology integration	
		Multiple media were used to explain the task and guidelines provided (multiple representation of task)	
		Questions were ill structured to provoke different perspective	
	Exploration	Students could discuss their thoughts to the task in (group) discussion forums	
		Students view to the task were modelled by teacher	
	Connecting ideas	Students brainstormed ideas using mind mapping and discussion forums	
		Teacher scaffold students' ideas – guiding students to think	
	Skill development	Use of industry/professional digital tools and apps to complete task	
		Prompt feedback/comment was provided on students work	
		Students were encouraged to reflect on the learning – steps in arriving at the solution	
Teaching Presence	Instructional Design and Management	Teacher introduces himself.	Short video
			Zoom
			LMS and Zoom
		Teacher explains of the theoretical underpinning of the course design.	
		The course goals were clearly stated.	

(*continued on next page*)

(*continued*)

Presence	Elements	Strategies used	Online tools
		The grading guidelines was explained.	
		Task is released before hand	
		Rubrics were provided for each task to guide students.	
		Students were encouraged to use the Gremlin Forum to provide feedback/ comment on the course design.	
	Building Understanding	Students completed different graded activities weekly eg written and video presentations.	LMS, recorded
		Task involved individual and group work, peer review	Zoom Meeting
		Critical discussion	
		Weekly reflection.	
		External links were provided to allow students to explore the topics outside the LMS.	
		Students were constantly reminded of due dates on tasks.	
		Unit forum to diagnose difficulty in the unit	
	Direct instruction	Weekly meetings to present content	Zoom
		Teacher demonstrates how to complete and submit task	Zoom
		Help forum to allow for students to share their problem (this was attended to by students or TA and prompt feedback or support is provided)	LMS
		External links were provided as additional resources for reference	Internet resources (Journals, Blogs and YouTube videos
		T/A's pick comments and questions from Zoom chats	Zoom
		Students were giving opportunity to interact with teacher before, during or after presentation	LMS, Zoom
Learner presence	Self-Regulation	Personal goal setting and time management	Google calendar
	Self-Regulation	Allocate time for learning new concept	Google calendar and external resources
	Self-Efficacy	Access external resource for more insight	Online videos, Internet resources
	Self-Efficacy	Access support from facilitator	LMS support Forum/contact hours
	Self-Regulation	Optional/non-graded activities to reflect on learning	Reflection in LMS, non-graded activities
	Self-Regulation	Confirm knowledge	Videos, micro credentials
	Self-Efficacy	Share problem with classmates	LMS Forum

References

[1] Shivangi Dhawan, Online learning: a panacea in the time of COVID-19 crisis, J. Educ. Technol. Syst. 49 (1) (2020) 5–22, https://doi.org/10.1177/0047239520934018.

[2] S. Ashour, G.A. El-Refae, E.A. Zaitoun, Post-pandemic higher education: perspectives from university leaders and educational experts in the United Arab Emirates, Higher Education for the Future 8 (2) (2021) 219–238, https://doi.org/10.1177/23476311211007261.

[3] C. Li, F. Lalani, The COVID-19 pandemic has changed education forever, in: World Economic Forum (Vol. 29). The Rise of Online Learning during the COVID-19 Pandemic World Economic Forum (weforum.Org), 2020, April.

[4] Z. Akyol, D.R. Garrison, The development of a community of inquiry over time an online course: understanding the progression and integration of social, cognitive and teaching presence, J. Async. Learn. Network 12 (2008) 3–22. https://files.eric.ed.gov/fulltext/EJ837483.pdf.

[5] J.C. Richardson, Y. Maeda, J. Lv, S. Caskurlu, Social presence in relation to students' satisfaction and learning in the online environment: a meta-analysis, Comput. Hum. Behav. 71 (2017) 402–417, https://doi.org/10.1016/j.chb.2017.02.001.

[6] M.H. Cho, S. Tobias, Should instructors require discussion in online courses? Effects of online discussion on community of inquiry, learner time, satisfaction, and achievement, Int. Rev. Res. Open Dist. Learn. 17 (2) (2016) 123–140, https://doi.org/10.19173/irrodl.v17i2.2342.

[7] M. Saadatmand, L. Uhlin, M. Hedberg, L. Åbjörnsson, M. Kvarnström, Examining learners' interaction in an open online course through the community of inquiry framework, Eur. J. Open Dist. E Learn. 20 (1) (2017) 61–79, https://doi.org/10.1515/eurodl-2017-0004.

[8] D. Rahayu, Students' E-learning experience through a synchronous Zoom web conference system, J. ELT Res.: The Academ. J. Studies in English Lang. Teach. Learn. (2020) 68–79, https://doi.org/10.22236/JER_Vol5Issue1.

[9] H. Fiock, Designing a community of inquiry in online courses, Int. Rev. Res. Open Dist. Learn. 21 (1) (2020) 135–153, https://doi.org/10.19173/irrodl.v20i5.3985.

[10] D.R. Garrison, T. Anderson, W. Archer, Critical inquiry in a text-based environment: computer conferencing in higher education, Internet High Educ. 2 (2) (2000) 87–105, https://doi.org/10.1016/S1096-7516(00)00016-6.

[11] Z. Akyol, D.R. Garrison, M.Y. Ozden, Development of a community of inquiry in online and blended learning contexts, Procedia-Social and Behavioral Sciences 1 (1) (2009) 1834–1838, https://doi.org/10.1016/j.sbspro.2009.01.324.

[12] B. Bervell, I.N. Umar, Validation of the UTAUT model: Re-considering non- linear relationships of exogeneous variables in higher education technology acceptance research, Eurasia J. Math. Sci. Technol. Educ. 13 (10) (2017) 6471–6490, https://doi.org/10.12973/ejmste/78076.

[13] B. Means, Y. Toyama, R. Murphy, M. Bakia, K. Jones, Evaluation of Evidence-Based Practices in Online Learning: A Meta-Analysis and Review of Online Learning Studies, US Department of Education, Washington DC, 2009. http://repository.alt.ac.uk/id/eprint/629.

[14] S. Caskurlu, Y. Maeda, J.C. Richardson, J. Lv, A meta-analysis addressing the relationship between teaching presence and students' satisfaction and learning, Comput. Educ. 157 (2020), 103966, https://doi.org/10.1016/j.compedu.2020. 103966.

[15] F.P. Yandra, B. Alsolami, I.O. Sopacua, W. Prajogo, The role of community of inquiry and self-efficacy on accounting students' satisfaction in online learning environment, Jurnal Siasat Bisnis (2021) 1–16, https://doi.org/10.20885/jsb. vol25.iss1.art1.

[16] E. Ozturk, Facebook as a new community of inquiry environment: an investigation in terms of academic achievement and motivation, J. Baltic Sci. Educ. 14 (1) (2015) 20. https://www.ceeol.com/search/article-detail?id=1023052.
[17] J.L.F. Choy, C.L. Quek, Modelling relationships between students' academic achievement and community of inquiry in an online learning environment for a blended course, Australas. J. Educ. Technol. 32 (4) (2016). https://doi.org/10.14742/ajet.2500.
[18] M. Kang, B.T. Liew, J. Kim, Y. Park, Learner presence as a predictor of achievement and satisfaction in online learning environments, Int. J. e Learn. 13 (2) (2014) 193–208. https://www.learntechlib.org/primary/p/39342/.
[19] P. Shea, T. Bidjerano, Learner presence: towards a theory of self-efficacy, self-regulation, and the development of a communities of inquiry in online and blended learning environments, Comput. Educ. 55 (4) (2010) 1721–1731. https://doi.org/10.1016/j.compedu.2010.07.017.
[20] D.R. Garrison, M. Cleveland-Innes, T.S. Fung, Exploring causal relationships among teaching, cognitive and social presence: student perceptions of the community of inquiry framework, Internet High Educ. 13 (1–2) (2010) 31–36, https://doi.org/10.1016/j.iheduc.2009.10.002.
[21] C.A. Honig, D. Salmon, Learner presence matters: a learner-centered exploration into the community of inquiry framework, Online learning Journal 25 (2) (2021) 95–119. https://eric.ed.gov/?id=EJ1301728.
[22] R. Garrison, Community of inquiry framework: validation & instrument development, Instructor 1 (2) (2007) 1–12.
[23] K. Swan, D.R. Garrison, J.C. Richardson, A constructivist approach to online learning: the community of inquiry framework, in: Information Technology and Constructivism in Higher Education: Progressive Learning Frameworks, IGI Global, 2009, pp. 43–57, https://doi.org/10.4018/978-1-60566-654-9.ch004.
[24] M. Wang, The Construction of Shared Knowledge in an Internet-Based Shared Environment for Expeditions (iExpeditions): A Study of External Factors Implying Knowledge Construction, University of Missouri-Columbia, 2001.
[25] A. Lantz-Andersson, M. Lundin, N. Selwyn, Twenty years of online teacher communities: a systematic review of formally-organized and informally-developed professional learning groups, Teach. Teach. Educ. 75 (2018) 302–315, https://doi.org/10.1016/j.tate.2018.07.008.
[26] A.P. Rovai, Building and sustaining community in asynchronous learning networks, Internet High Educ. 3 (2000) 285–297, https://doi.org/10.1016/S1096-7516(01)00037-9.
[27] R. McKerlich, M. Riis, T. Anderson, B. Eastman, Student perceptions of teaching presence, social presence, and cognitive presence in a virtual world, MERLOT J. Online Learn. Teach. 7 (3) (2011) 324–336. http://hdl.handle.net/2149/3519.
[28] S. Koseoglu, A. Koutropoulos, Teaching presence in MOOCs: perspectives and learning design strategies, in: Paper Presented at the 10th International Conference on Networked Learning 2016, Lancaster, 2016.
[29] X. Feng, J. Xie, Y. Liu, Using the community of inquiry framework to scaffold online tutoring, Int. Rev. Res. Open Dist. Learn. 18 (2) (2017) 162–188, https://doi.org/10.19173/irrodl.v18i2.2362.
[30] D.R. Garrison, M. Cleveland-Innes, Facilitating cognitive presence in online learning: interaction is not enough, Am. J. Dist. Educ. 19 (3) (2005) 133–148, https://doi.org/10.1207/s15389286ajde1903_2.
[31] M. Jansson, S. Hrastinski, S. Stenbom, F. Enoksson, Online question and answer sessions: how students support their own and other students' processes of inquiry in a text-based learning environment, Internet High Educ. 51 (2021), 100817, https://doi.org/10.1016/j.iheduc.2021.100817.
[32] C. Wishart, G.R. Guy, Analyzing responses, moves, and roles in online discussions, Interdiscip. J. E-Learn. Learn. Objects 5 (1) (2009) 129–144. https://www.learntechlib.org/p/44826/.
[33] H. Zhao, K.P. Sullivan, Teaching presence in computer conferencing learning environments: effects on interaction, cognition and learning uptake, Br. J. Educ. Technol. 48 (2) (2017) 538–551, https://doi.org/10.1111/bjet.12383.
[34] J. Short, E. Williams, B. Christie, The Social Psychology of Telecommunications, Wiley, Toronto; London; New York, 1976.
[35] G.E. Stephens, K.L. Roberts, Facilitating collaboration in online groups, J. Educa. Online 14 (1) (2017) 1–16. https://eric.ed.gov/?id=EJ1133614.
[36] J. Pool, G. Reitsma, D. van den Berg, Revised community of inquiry framework: examining learner presence in a blended mode of delivery, Online Learn. 21 (3) (2017) 153–165, https://doi.org/10.24059/olj.v21i3.866.
[37] M. Knowles, Self Directed Learning: A Guide for Learners and Teachers, Association Press, New York, 1975 eric.ed.gov/?id=ED114653.
[38] I.S. Weerasinghe, R.L. Fernando, Students' satisfaction in higher education, Am. J. Educ. Res. 5 (5) (2017) 533–539. https://ssrn.com/abstract=2976013.
[39] C. Wright, M. O'Neill, Service quality evaluation in the higher education sector: an empirical investigation of students' perceptions, High Educ. Res. Dev. 21 (1) (2002) 23–39, https://doi.org/10.1080/07294360220124639.
[40] G.F. Howell, J.M. Buck, The adult student and course satisfaction: what matters most? Innovat. High. Educ. 37 (3) (2012) 215–226, https://doi.org/10.1007/s10755-011-9201-0.
[41] S.A. Ngubane-Mokiwa, S.B. Khoza, Using community of inquiry (CoI) to facilitate the design of a holistic E-learning experience for students with visual impairments, Educ. Sci. 11 (4) (2021) 152, https://doi.org/10.3390/educsci 11040152.
[42] L. Rourke, T. Anderson, Using peer teams to lead online discussions, J. Interact. Media Educ. 2002 (1) (2002). http://hdl.handle.net/2149/730.
[43] K.M. Law, S. Geng, T. Li, Student enrollment, motivation and learning performance in a blended learning environment: the mediating effects of social, teaching, and cognitive presence, Comput. Educ. 136 (2019) 1–12, https://doi.org/10.1016/j.compedu.2019.02.021.
[44] O. Skrypnyk, S. Joksimović, V. Kovanović, Roles of course facilitators, learners, and technology in the flow of information of a MOOC, Int. Rev. Res. Open Dist. Learn. 16 (3) (2015), https://doi.org/10.19173/irrodl.v16i3.2170.
[45] D.R. Garrison, Thinking Collaboratively: Learning in a Community of Inquiry, Routledge, 2015, https://doi.org/10.4324/9781315740751.
[46] S. Özbey, M. Köyceğiz, Investigation of the effect of social skills training on the motivation levels of preschool children, Int. Electron. J. Environ. Educ. 11 (5) (2019) 477–486. https://www.iejee.com/index.php/iejee/article/view/769.
[47] M.A. Asiry, Learning styles of dental students, The Saudi J. Dental Res. 7 (1) (2016) 13–17, https://doi.org/10.1016/j.sjdr.2015.02.002.
[48] T. Anderson, J. Dron, Three generations of distance education pedagogy, Int. Rev. Res. Open Dist. Learn. 12 (3) (2011) 80–97, https://doi.org/10.19173/irrodl.v12i3.890.
[49] S.L. Benton, W.E. Cashin, Student ratings of instruction in college and university courses, in: Higher Education: Handbook of Theory and Research, Springer, Dordrecht, 2014, pp. 279–326, https://doi.org/10.1007/978-94-017-8005-6_7.
[50] M. Drouin, What's the story on evaluations of online teaching? in: M.E. Kite (Ed.), Effective Evaluation of Teaching: A Guide for Faculty and Administrators Society for the Teaching of Psychology, Washington, DC, 2012, pp. 60–70.
[51] J.C. Richardson, K. Swan, Examining social presence in online courses in relation to students' perceived learning and satisfaction, J. Async. Learn. Network 7 (1) (2003) 68—88.
[52] D. Annand, Social presence within the community of inquiry framework, Int. Rev. Res. Open Dist. Learn. 12 (5) (2011) 40–56, https://doi.org/10.19173/irrodl.v12i5.924.
[53] S.M. Lee, The relationships between higher order thinking skills, cognitive density, and social presence in online learning, Internet High Educ. 21 (2014) 41–52, https://doi.org/10.1016/j.iheduc.2013.12.002.
[54] A. Armellini, M. De Stefani, Social presence in the 21st century: an adjustment to the Community of Inquiry framework, Br. J. Educ. Technol. 47 (6) (2016) 1202–1216, https://doi.org/10.1111/bjet.12302.
[55] J.L.F. Choy, C.L. Quek, Modelling relationships between students' academic achievement and community of inquiry in an online learning environment for a blended course, Australas. J. Educ. Technol. 32 (4) (2016), https://doi.org/10.14742/ajet.2500.
[56] Y.J. Joo, K.Y. Lim, E.K. Kim, Online university students' satisfaction and persistence: examining perceived level of presence, usefulness and ease of use as predictors in a structural model, Comput. Educ. 57 (2) (2011) 1654–1664, https://doi.org/10.1016/j.compedu.2011.02.008.
[57] P.J. Shea, A.M. Pickett, W.E. Pelz, Enhancing student satisfaction through faculty development: the importance of teaching presence, in: J. Bourne, J.C. Moore (Eds.), Elements of Quality Online Education: into the Mainstream, vol. 5, Sloan Center for Online Education, Needham, MA, 2004, pp. 39–59.
[58] B. Oyarzun, C. Hancock, S. Salas, F. Martin, Synchronous meetings, community of inquiry, COVID-19, and online graduate teacher education, Journal of Digital Learning in Teacher Education (2021) 1–17, https://doi.org/10.1080/21532974.2021.1890653.

[59] R.K. Ladyshewsky, Instructor presence in online courses and student satisfaction, Int. J. Scholarsh. Teach. Learn. 7 (1) (2013) 1–23, https://doi.org/10.20429/ijsotl.2013.070113.
[60] L.L.D. Stermer, The Community of Inquiry Framework and Academic Advising: Online Student Perceptions, Doctoral dissertation, Kansas State University, 2018.
[61] I.E. Allen, J. Seaman, Class Differences: Online Education in the United States, 2010, Sloan Consortium (NJ1), 2010. https://eric.ed.gov/?id=ed529952.
[62] M.G. Moore, G. Kearsley, Distance Education: A Systems View of Online Learning, Wadsworth, Cengage Learning, Belmont, CA, 2012.
[63] H.J. So, T.A. Brush, Student perceptions of collaborative learning, social presence and satisfaction in a blended learning environment: relationships and critical factors, Comput. Educ. 51 (1) (2008) 318–336. https://doi.org/10.1016/j.compedu.2007.05.009.
[64] Z.L. Berge, L. Muilenburg, Seamless learning: an international perspective on next-generation technology-enhanced learning, in: Handbook of Mobile Learning, Routledge, 2013, pp. 133–146.
[65] J.B. Arbaugh, Does the community of inquiry framework predict outcomes in online MBA courses? Int. Rev. Res. Open Dist. Learn. 9 (2) (2008) 1–21, https://doi.org/10.19173/irrodl.v9i2.490.
[66] Y.S. Wang, Assessment of learner satisfaction with asynchronous electronic learning systems, Inf. Manag. 41 (1) (2003) 75–86, https://doi.org/10.1016/S0378-7206(03)00028-4.
[67] J.F. Hair, M. Sarstedt, C.M. Ringle, S.P. Gudergan, Advanced Issues in Partial Least Squares Structural Equation Modeling, Sage Publications, 2017. dl.acm.org//abs/10.5555/3158980.
[68] J.F. Hair, G.T.M. Hult, C.M. Ringle, M. Sarstedt, A Primer on Partial Least Squares Structural Equation Modeling, first ed., Sage, Thousand Oaks, 2014. http://hdl. handle.net/11420/4095.
[69] K. Sijtsma, On the use, the misuse, and the very limited usefulness of Cronbach's alpha, Psychometrika 74 (1) (2009) 107–120, https://doi.org/10.1007/s11336-008-9101-0.
[70] L.J. Cronbach, R.J. Shavelson, My current thoughts on coefficient alpha and successor procedures, Educ. Psychol. Meas. 64 (3) (2004) 391–418, https://doi.org/10.1177/0013164404266386.
[71] R.B. Kline, Principles and Practice of Structural Equation Modelling Methodology in the Social Sciences, fourth ed., Guilford Publication, NY, 2015.
[72] J. Henseler, C.M. Ringle, M. Sarstedt, A new criterion for assessing discriminant validity in variance-based structural equation modeling, J. Acad. Market. Sci. 43 (2015) 115–135, https://doi.org/10.1007/s11747-014-0403-8.
[73] N. Kock, Common method bias in PLS-SEM: a full collinearity assessment approach, Int. J. e-Collaboration 11 (4) (2015) 1–10, https://doi.org/10.4018/ijec.2015100101.
[74] J. Yeap, T. Ramayah, P. Soto-Acosta, Factors propelling the adoption of m-learning among students in higher education, Electron. Mark. 26 (4) (2015) 323–338, https://doi.org/10.1007/s12525-015-0214-x.
[75] C.M. Ringle, M. Sarstedt, Gain more insight from your PLS-SEM results: the importance-performance map analysis, Ind. Manag. Data Syst. 116 (9) (2016) 1865–1886, https://doi.org/10.1108/IMDS-10-2015-0449.
[76] T. Anderson, L. Rourke, D.R. Garrison, W. Archer, Assessing teaching presence in a computer conferencing context, J. Async. Learn. Network 5 (2) (2001) 1–17. http://hdl.handle.net/2149/725.
[77] V. Rolim, R. Ferreira, R.D. Lins, D. Găsević, A network-based analytic approach to uncovering the relationship between social and cognitive presences in communities of inquiry, Internet High Educ. 42 (2019) 53–65.