Education Tech Research Dev (2023) 71:481–504
https://doi.org/10.1007/s11423-023-10187-3

RESEARCH ARTICLE

Examinations of the relationships between self-efficacy, self-regulation, teaching, cognitive presences, and learning engagement during COVID-19

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Accepted: 2 January 2023 / Published online: 30 January 2023

Abstract
This study investigated the relationships between self-efficacy, self-regulation, and teaching presence, cognitive presence, and learning engagement during the pandemic. A total of 1435 undergraduate students in Korea completed an online survey on their learning experiences during COVID-19. The findings indicate that self-efficacy had a positive relationship with teaching presence and cognitive presence as well as self-regulation. No direct relationship between self-efficacy on learning engagement was found; however, the relationship between self-efficacy and learning engagement was fully mediated by self-regulation, teaching presence, and cognitive presence. Self-regulation had a positive relationship with both cognitive presence and learning engagement. Teaching presence had a positive impact on cognitive presence, but not on learning engagement. However, cognitive presence fully mediated the relationship between teaching presence and learning engagement. In effect, this study lends support to the significance of the role of cognitive presence in online learning.

Keywords Self-efficacy · Self-regulation · Teaching presence · Cognitive presence · Learning engagement · Community of inquiry (CoI) · COVID-19

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Introduction

Our lives have considerably changed due to the unprecedented COVID-19 pandemic. Teachers and students had to adjust to dramatic changes in the dominant teaching modality so they could meet virtually or in a blended learning environment (i.e., a combination of online and face-to-face classes) to prevent transmission of the contagious disease. Given that distance learning requires a physical and/or temporal separation between teachers and students, it is a substantively different learning experience than in a physical classroom (Keegan, 1980). Educators, parents, and students have expressed concern that online learners feel isolated and lonely because teachers and peer learners are not fully tangible and any communication between them must be mediated in online learning environments (Morrison-Smith et al., 2020; Shi et al., 2008; Whiteside et al., 2014).

The community of inquiry (CoI) framework was developed to explain these unique learning experiences in online learning environments by introducing three interdependent types of presence: (1) teaching presence, (2) cognitive presence, and (3) social presence (Garrison et al., 2000). Teaching presence refers to students' perceptions of their teachers' efforts or activities to facilitate learning in an online learning environment, including the instructional design/organization, facilitating the discourse, and direct instruction. Cognitive presence refers to "the extent to which learners are able to construct and confirm meaning through sustained reflection and discourse in a critical community of inquiry" (Garrison et al., 2000, p. 5). Social presence refers to "the needs for online learners to be able to address the challenge of projecting themselves as real people" (Shea & Bidjerano, 2009, p. 545), even in a virtual learning environment. The three interdependent types of presence are equally important to the functioning and effectiveness of online classes and learning communities.

Online classes have different class structures and teaching methods, from online synchronous instructor-led classes (i.e., real-time) to asynchronous learner-centered programs with no live instructor (i.e., anytime and anywhere) and a blend of the two styles. In particular, asynchronous online learning gives learners more autonomy in learning in the place and time for learning, and even how learners learn. In this modality, self-regulation is critical to student success to help them make effective use of their time and participate in learning. Zimmerman (2000, p. 14) refers to self-regulation as "self-generated thoughts, feelings, and behaviors that are oriented to attaining goals." Self-regulated learners are expected to proactively and self-reliantly manage their learning process to realize successful learning goals. Given that there is generally less direct interaction between teachers and students in online learning than face-to-face environments, learners' self-regulation may be critical for successful learning in this environment.

After more than two years of operating in online learning environments during the pandemic, it is vital to begin to examine and compare the effects of self-regulation and teaching presence on learning outcomes, including learning engagement. In response, this paper examined the effects of self-efficacy, self-regulation, teaching presence, and cognitive presence on learning engagement during COVID-19.

Literature review

The theoretical framework of this study includes: (1) the community of inquiry (CoI) framework, (2) self-efficacy, and (3) self-regulation theory. The CoI framework, which is based on social constructivism and heavily influenced by Dewey's practical inquiry, was

initially introduced by Garrison et al. (2000) (Swan & Ice, 2010). During the COVID-19 pandemic, self-efficacy and self-regulation became vital elements for successful learning due, in part, to the fact that teaching and learning was occurring purely online in synchronous and asynchronous environments or had replaced aspects of face-to-face learning by employing a blended learning approach. Given that the effects of self-efficacy and self-regulation on learning achievement and engagement had gained increasing attention in online learning environments, we decided to employ self-regulation theory as the theoretical basis of the current study.

Community of inquiry (CoI) framework

Garrison (2011) defined CoI as "Where individuals experiences and ideas are recognized and discussed in light of societal knowledge, norms, and values" (p. 4). A basic premise of the CoI framework is that learning occurs through interaction between teachers and students and/or between students and students, in the intersection of cognitive presence, social presence, and teaching presence.

Cognitive presence is pertinent to achieving learning goals or obtaining learning outcomes since it is an essential component of critical thinking (Cho et al., 2017; Vaughan & Garrison, 2005; Yang et al., 2016). Social presence means individuals' capabilities to project their own feelings and attributes onto others (Garrison et al., 2000; Shea & Bidjerano, 2009). The role of teaching presence is to help or facilitate learning autonomy which leads to successful learning outcomes by enhancing cognitive presence and social presence (Caskurlu et al., 2020; Shea & Bidjerano, 2009; Swan et al., 2009). Figure 1 illustrates the relationship among the three types of presence. The present study, notably, focused on cognitive presence and teaching presence. Cognitive presence is a main construct of the process in which learners construct and validate meaning through interaction with teachers, other learners, and learning content (Joksimović et al., 2015). Given that teaching presence influences learning by facilitating cognitive presence and social presence (Caskurlu et al., 2020; Garrison et al., 2000), teaching presence could be the "binding" element of CoI.

Many researchers have emphasized the importance of cognitive presence in higher education since it is fundamental to successful learning (e.g., Kozen & Richardson, 2014; Vaughan & Garrison, 2005). Cognitive presence explains how learning occurs using the practical inquiry cycle, students' learning experiences from a triggering event, to exploration, integration, and finally resolution (Vaughan & Garrison, 2005). Akyol and Garrison (2008, 2011) found that cognitive presence contributed the most to learning outcomes in their studies. They reported that cognitive presence explained 70% of the variance of perceived (i.e., subjective) learning and approximately 20% of the variance of actual (i.e., objective) learning outcomes. Kozen and Richardson (2014) reported that cognitive presence mediates the relationship between teaching presence and social presence, and teachers should try to increase students' cognitive presence to enhance social presence.

Teaching presence refers to "the design, facilitation, and direction of cognitive and social processes for the purpose of realizing personally meaningful and educationally worthwhile learning outcomes" (Anderson et al., 2001, p. 5). Since teaching presence facilitates cognitive presence and social presence to fulfill learning goals (e.g., active discourse or knowledge construction), it is an influencing element of the other two types of presence. Given the physical, temporal, and psychological distance between teachers and learners in online learning environments, Garrison et al. (2000) emphasized the importance of

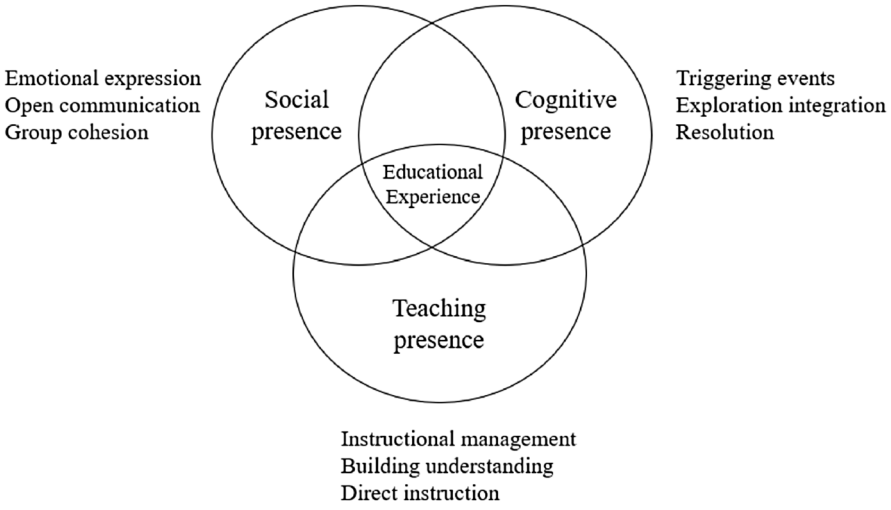


Fig. 1 Community of Inquiry. *Note*. Adapted from Fig. 1. Elements of an educational experience (Garrison et al., 2000, p. 88)

effective teaching presence and explained the three sub-categories: (1) instructional management, (2) building understanding, and (3) direct instruction.

Instructional management relates to planning for classes, including designing curriculum, instructional methods and materials, and evaluation. Building understanding refers to stimulating and challenging students' thinking processes by providing opportunities to share meaning with other students, debating issues, and obtaining research consensus to acquire knowledge. Last, direct instruction requires that teachers practice immediacy and have the expertise to encourage student reflection and facilitate efficient discourse by questioning, scaffolding, providing guidance and feedback, and assessing learning progress (Caskurlu et al., 2020).

Vaughan and Garrison (2005) recommended that teachers systematically design learning activities to achieve cognitive presence using practical inquiry such as employing a triggering event or fostering learner exploration, knowledge integration, or problem resolution. In terms of the characteristics of online learning environments, Caskurlu et al. (2020) suggested that teachers/instructors should design instructionally sound courses, establish, and maintain a positive course (or learning) climate, monitor students' learning needs, and promote student autonomy for learning. In providing some further grounding for these suggestions, Shea and Bidjerano (2009) found that teaching presence has a significant direct and total effect on cognitive presence, while social presence has only a significant direct effect on cognitive presence. Yang et al. (2016) also reported similar findings that the influence of teaching presence leads to greater subjective learning outcomes (about 39% of the variance) than objective learning outcomes (about 10% of the variance).

Caskurlu et al. (2020) conducted a meta-analysis to investigate the relationship between teaching presence and student satisfaction and perceived learning in online courses. They estimated the 82 effect sizes from 30 studies and the overall findings indicated a strong relationship between teaching presence and satisfaction and perceived learning. Specifically, the results indicated that there was a very high correlation between teaching presence and satisfaction, and between teaching presence and perceived learning. Kozen and

Richardson (2014) examined the relationship among the three types of presence using Spearman's correlation analysis. The results indicated a high correlation between teaching presence and cognitive presence. This strong correlation remained even when the effect of social presence was controlled using partial correlation. Similarly, Akyol and Garrison (2008) reported a strong correlation between teaching presence and cognitive presence.

Several other studies have examined the effects of the three types of presence using structural equation modeling or regression analyses. Archibald (2010) treated teaching presence and social presence as independent variables and cognitive presence as an outcome. At about the same time, Ke (2010) treated social presence and cognitive presence as outcomes and teaching presence as an independent variable in examining the relationships among the three types of presence. These research findings confirm the significant influence of teaching presence on cognitive presence. Thus, the present study treated teaching presence as an independent variable and cognitive presence as a dependent variable.

Self-regulation, self-efficacy, and CoI

Zimmerman and Schunk (2011) defined self-regulation as "the processes whereby learners personally activate and sustain cognitions, affects, and behaviors that are systematically oriented toward the attainment of personal goals" (p. 1). Self-regulation plays a pivotal role to help learners reach their learning goals (Zimmerman, 2000). According to Pintrich, (2000), self-regulated learners "set goals for their learning and then attempt to monitor, regulate, and control their cognition, motivation, and behavior, guided and constrained by their goals and the contextual features of the environment" (p. 453). In the same vein, Cho et al. (2017) listed four qualities of self-regulated learners: (1) intrinsic orientation, (2) high confidence in learning, (3) high control of learning beliefs, and (4) high task values.

High confidence in learning is pertinent to self-efficacy, which is defined as "beliefs in one's capabilities to organize and execute the courses of action required to produce given attainments" (Bandura, 1997, p. 3). Self-efficacy has been extensively studied in education as a predictor of learning outcomes, goal achievement, and learning engagement (Huang, 2016; Tsai et al., 2011). Recent studies on self-efficacy have reported that the effects of self-efficacy on learning outcomes remained the same during COVID-19 pandemic (Heo et al, 2022; Hong et al., 2022).

In a recent study, El-Sayad et al. (2021) examined the effects of self-efficacy, teaching presence, and perceived usefulness of online learning systems on behavioral, cognitive, and emotional engagement of Egyptian undergraduates during the COVID-19 pandemic. They found that self-efficacy influenced behavioral and emotional engagement but not cognitive engagement during the pandemic. Importantly, teaching presence affected all three types of engagement in their study. In a study published that same year, She et al. (2021) surveyed 1,504 Chinese undergraduates to investigate the relationship between interaction (e.g., interaction between instructors and students, between students and students, and between students and course content), self-efficacy, student engagement, and online learning satisfaction during COVID-19. Importantly, they discovered that interaction affected self-efficacy, student engagement, and online learning satisfaction. She et al., (2021) also found that self-efficacy positively influenced student engagement but negatively affected online learning satisfaction.

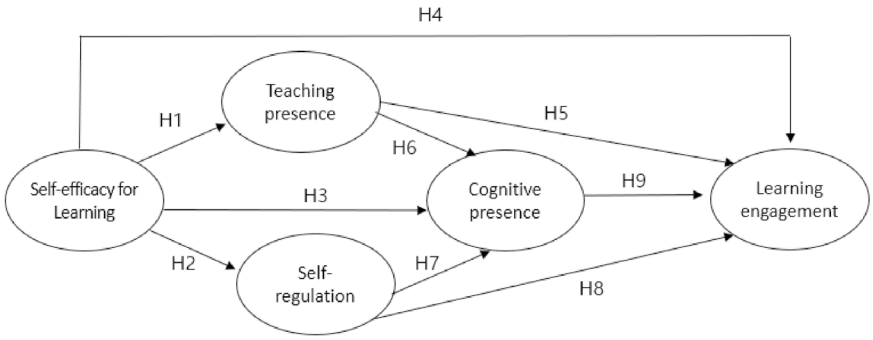
Self-regulated learning (SRL) can be viewed as another attribute for successful engagement in online learning although it interacts with learners' perceptions of cognitive

presence and teaching presence (Shea & Bidjerano, 2010). In a much-needed study addressing the growing use of flipped classroom approaches, Shih et al. (2019) pointed out the critical role of learners' self-regulation in successful online learning in a flipped classroom. Also worth noting is Cho et al.'s (2017) cluster analysis study which discovered that highly self-regulated learners showed a stronger sense of CoI than low self-regulated learners. Similarly, Kilis and Yıldırım (2018) also highlighted the significant contribution of self-regulation for CoI. In other words, students with high intrinsic goal orientation, high confidence in learning, high control of learning beliefs, and higher task value are expected to perceive high teaching presence, cognitive presence, and social presence in online learning environments. Based on the literature review, the research model and nine hypotheses of this study were designed and are illustrated in Fig. 2.

Methods

The context of the study and participants

This study was conducted with students in a 4-year, medium-size university in Korea. Before the pandemic, students were expected to attend physically in class on campus every day because the university did not officially allow instructors to deliver courses online. However, due to the pandemic, more than 50% of courses were delivered through online means in 2021. More specifically, during the COVID-19 pandemic, the university offered



H1: Self-efficacy for learning has a positive relationship with teaching presence.

H2: Self-efficacy for learning has a positive relationship with self-regulation.

H3: Self-efficacy for learning has a positive relationship with cognitive presence.

H4: Self-efficacy for learning has a positive relationship with learning engagement.

H5: Teaching presence has a positive relationship with learning engagement.

H6: Teaching presence has a positive relationship with cognitive presence.

H7: Self-regulation has a positive relationship with cognitive presence.

H8: Self-regulation has a positive relationship with learning engagement.

H9: Cognitive presence has a positive relationship with learning engagement.

Fig. 2 Research model

three types of courses: (1) fully online classes, (2) blended classes, and (3) onsite classes. The selected class format was reflective of social distancing policy, the class type (e.g., whether it was lecture-based, if the class required experiments or hands-on activities, etc.), class size, and each instructor's personal preference. For example, courses with more than 40 students were required to be delivered online according to the social distancing policy. Even students who attended classes physically were unable to participate in other activities by the university's COVID-19 prevention strategy. Given the various input factors determining the delivery format, students' learning experiences were more heterogeneous than before the COVID-19 pandemic. In addition, the number of days students went to campus or learned online varied considerably. An online survey was distributed to students through the university's electronic bulletin board from May to June 2021 (i.e., after the end of Spring semester). Survey participation was voluntary, and 1435 students (538 male and 897 female students) out of about 7,300 undergraduate students in this university completed the survey during a span of over two weeks. The participants included 321 freshmen (22.4%), 369 sophomores (25.7%), 361 juniors (25.2%), and 384 seniors or above (26.8%). The percentage of online classes that the participants took in Spring 2021 was somewhat equally distributed across student years. These undergraduate students went to campus 2.94 days or nearly 3 days per week (SD = 1.52) on average.

Measurement instruments

The survey consists of 53 questions, including (1) demographic information (seven items), (2) self-efficacy for learning (eight items), (3) teaching presence (13 items), (4) self-regulation (six items), (5) cognitive presence (12 items), and (6) learning engagement (seven items). Demographic information was collected on gender, class year, field of study, class types (i.e., online vs. blended vs. onsite or where the participants took classes) and the associated percentages, and how many days the participants went to school. The measurement scale was translated into Korean and reviewed by a bilingual faculty member who taught educational technology.

Self-efficacy was adopted from Pintrich et al.'s (1991) Motivated Strategies for Learning Questionnaire (MSLQ). Self-efficacy was measured with eight items, including "I expect to do well in this class" and "I'm certain I can master the skills being taught in this class." Self-regulation was measured using six items from Pintrich and de Groot's (1990) scale. The original questionnaire had nine items related to self-regulation; however, three items were deleted (i.e., "I work on practice exercises and answer end of chapter questions even when I don't have to," "I often find that I have been reading for class but don't know what it is all about," and "I find that when the teacher is talking I think of other things and don't really listen to what is being said") because their low factor loading (i.e., below 0.5) did not satisfy the requirement of structural equation modeling (Hair et al., 2006; Kline, 2011). Example questions for self-regulation include, "I ask myself questions to make sure I know the material I have been studying" and "When I'm reading, I stop once in a while and go over what I have read."

Teaching presence and cognitive presence were measured with the community of inquiry (CoI) survey instrument by Arbaugh et al. (2008). Teaching presence (13 items) has three subcategories: design and organization (four items), facilitation (six items), and direct instruction (three items). Example items related to teaching presence include, "The instructor provided clear instructions on how to participate in course learning activities" and "The instructor provided feedback in a timely fashion."

Cognitive presence (12 items) consists of four sub-categories: a triggering event, exploration, integration, and resolution (for each of three items). Sample questions included "Course activities piqued my curiosity" and "I have developed solutions to course problems that can be applied in practice." We also adopted Schreiner and Louis' (2011) Engaged Learning Index to measure learning engagement. Three items were deleted from the original 10 questions because their factor loadings were below 0.5, including, "In the last week, I've been bored in class a lot of the time" and "Often I find my mind wandering during class." Sample items of learning engagement include, "I can usually find ways of applying what I'm learning in class to something else in my life" and "I feel energized by the ideas that I am learning in most of my classes." For details on the items and measurement scales, see Table 1 and Appendix A.

Data analysis

We applied structural equation modeling (SEM) to examine the relationships between self-efficacy, self-regulation, teaching presence, cognitive presence, and learning engagement. Prior to conducting structural equation modeling, confirmatory factor analysis (CFA) was performed to check the convergent validity and discriminant validity of the indicators of variables. Since the survey included 46 items from the five primary variables, item parceling was conducted for statistical purposes, which is a widely used multivariate approach. Little et al. (2002) defined a (item) parcel as "aggregate-level indicator comprised of the sum (or average) of two or more items, responses, or behaviors" (p. 152). Since teaching presence and cognitive presence consist of three and four theoretical constructs, respectively, item parceling was conducted for the two variables using theoretical constructs. The results of teaching presence with 13 items were converted into three measurement variables and cognitive presence with 12 items was converted to four measurement variables. The items of other variables, including self-efficacy, self-regulation, and learning engagement remained the same. In the end, we analyzed 28 measurement variables from 46 items. To estimate the convergent validity, we calculated average variance extracted (AVE) and composite reliability (CR). The CFA results confirmed that the factor loadings, AVE, and CR values of the data were acceptable (Fornell & Larcker, 1981) (see Table 2).

Since AVE values for the latent variables were greater than the squared correlation, discriminant validity for the measurement model was deemed to be satisfactory (see Table 3).

The comparative fit index (CFI), Tucker-Lewis index (TLI), root mean square error of approximation (RMSEA), standardized root mean square residual (SRMR), and a

Table 1 Research instruments

Variables	Number of items	Cronbach's alpha	Reference
Self-efficacy for learning	8	0.935	Pintrich et al., (1991)
Teaching presence	13	0.930	Arbaugh et al., (2008)
Cognitive presence	12	0.928	Arbaugh et al., (2008)
Self-regulation	6	0.760	Pintrich and Groot (1990)
Learning engagement	7	0.838	Schreiner and Louis, (2011)

chi-square test were used as multiple fit indices for analysis to evaluate any discrepancy between the proposed model and the data. The statistical software SPSS (version 24.0) and Amos (version 26.0) were used for data analysis.

Results

Descriptive analysis

Descriptive analysis indicated that the participants scored above neutral (i.e., above 3 points) on a 5-point Likert scale for self-efficacy for learning ($M = 3.55$, $SD = 0.80$), teaching presence ($M = 3.74$, $SD = 0.68$), self-regulation ($M = 3.72$, $SD = 0.59$), cognitive presence ($M = 3.74$, $SD = 0.66$), and learning engagement ($M = 3.53$, $SD = 0.65$). As presented

Table 2 Results of confirmatory factor analysis

Latent variable	Measurement variable	Factor loading (> 0.5)	AVE (> 0.5)	CR (> 0.7)
Self-efficacy for Learning	SE1	0.77	0.67	0.94
	SE2	0.81		
	SE3	0.81		
	SE4	0.80		
	SE5	0.83		
	SE6	0.85		
	SE7	0.77		
	SE8	0.83		
Teaching presence	TP1	0.79	0.82	0.93
	TP2	0.96		
	TP3	0.82		
Self-regulation	SR1	0.71	0.52	0.86
	SR2	0.50		
	SR3	0.56		
	SR4	0.63		
	SR5	0.59		
	SR6	0.56		
Cognitive presence	CP1	0.83	0.80	0.94
	CP2	0.83		
	CP3	0.86		
	CP4	0.82		
Learning engagement	Eng1	0.543	0.52	0.88
	Eng2	0.69		
	Eng3	0.75		
	Eng4	0.67		
	Eng5	0.58		
	Eng6	0.67		
	Eng7	0.71		

Table 3 Discriminant validity for the measurement model

Measures	SE	TP	SR	CP	LE	AVE	CR
Self-efficacy for learning (ρ2)	–	0.44 (0.19)	0.72 (0.52)	0.62 (0.38)	0.64 (0.41)	0.67	0.94
Teaching presence (ρ2)		–	0.44 (0.19)	0.72 (0.52)	0.61 (0.37)	0.82	0.93
Self-regulation (ρ2)			–	0.62 (0.38)	0.71 (0.50)	0.52	0.86
Cognitive presence (ρ2)				–	0.83 (0.69)	0.80	0.94
Learning Engagement (ρ2)					–	0.52	0.88

in Table 4, the correlations among the variables were all significant at $p < 0.001$, ranging from 0.36 to 0.71.

Means, standard deviations, kurtosis and skewness, and the correlations among the measurement variables were calculated (see Table 5). The measurement variables were deemed to be normally distributed because kurtosis and skewness ranged from − 1 to 1 (Morgan et al., 2001). Notably, the correlations among the measurement variables were all significant at $p < 0.001$.

Hypothesis testing

Prior to examining the hypotheses, the good of fitness of the hypothesized model was estimated. As shown in Table 6, the hypothesized model indicated a fair fit to the data ($\chi^2 = 1866.454$; $df = 341$; $\chi^2/df = 5.473$; $TLI = 0.930$; $CFI = 0.937$; $RMSEA = 0.056$; $SRMR = 0.042$).

Brown and Cudeck (1993) suggested that CFI and TLI values larger than 0.90 are considered a good fit between the proposed model and the data. As for the RMSEA value, below 0.05 indicates a close fit, 0.08 is a fair fit, and 0.10 is a borderline fit. A range from 0 and 0.08 of SRMR values is considered acceptable (Hu & Bentler, 1999).

The findings indicated that self-efficacy for learning had a positive relationship with teaching presence ($\beta = 0.448$, $t = 15.458$, $p < 0.001$), self-regulation ($\beta = 0.729$, $t = 21.119$, $p < 0.001$), and cognitive presence ($\beta = 0.212$, $t = 5.992$, $p < 0.001$); thus, H1, H2, and H3 were supported. However, we did not find a direct relationship between self-efficacy and learning engagement ($\beta = 0.056$, $t = 1.584$, *ns*); thus, H4 was rejected. Teaching presence had a positive relationship with cognitive presence ($\beta = 0.531$, $t = 20.585$, $p < 0.001$), thereby supporting H6. As shown in Table 7 and Fig. 3, no relationship was found between teaching presence and learning engagement ($\beta = 0.047$, $t = 1.584$, *ns*). Thus, H5 was

Table 4 Correlations among the variables

Measures	SE	TP	SR	CP	LE
Self-efficacy for learning	–	0.42**	0.62**	0.58**	0.61**
Teaching presence		–	0.36**	0.66**	0.54**
Self-regulation			–	0.48**	0.66**
Cognitive presence				–	0.71**
Learning engagement					–

$^{**}p < 0.001$, $^{*}p < 0.05$

Table 5 Descriptive analysis of measurement variables

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
SE1	–	0.62**	0.58**	0.55**	0.66**	0.68**	0.57**	0.67**	0.31**	0.27**	0.21**	0.42**	0.30**	0.25**
SE2		–	0.69**	0.75**	0.65**	0.64**	0.61**	0.63**	0.33**	0.33**	0.28**	0.45**	0.33**	0.27**
SE3			–	0.67**	0.64**	0.67**	0.62**	0.65**	0.36**	0.32	0.26**	0.46**	0.34**	0.30**
SE4				–	0.63**	0.61**	0.62**	0.60**	0.32**	0.34	0.28**	0.40**	0.33**	0.27**
SE5					–	0.74**	0.62**	0.68**	0.34**	0.33	0.26**	0.44**	0.31**	0.28**
SE6						–	0.65**	0.73**	0.37**	0.34	0.28**	0.45**	0.35**	0.32**
SE7							–	0.67**	0.33**	0.34	0.30**	0.41**	0.28**	0.28**
SE8								–	0.41**	0.37	0.31**	0.48**	0.32**	0.31**
TP1									–	0.76	0.64**	0.33**	0.15**	0.28**
TP2										–	0.79**	0.32**	0.13**	0.28**
TP3											–	0.26**	0.10**	0.20**
SR1												–	0.34**	0.36**
SR2													–	0.30**
SR3														–
SR4														
SR5														
SR6														
CP1														
CP2														
CP3														
CP4														
Eng1														
Eng2														
Eng3														
Eng4														

Table 5 (continued)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Eng5														
Eng6														
Eng7														
Mean	3.63	3.35	3.68	3.27	3.60	3.75	3.46	3.65	3.89	4.45	3.59	3.74	3.47	3.72
SD	0.98	0.97	0.90	0.95	0.99	0.91	0.98	0.93	0.71	0.87	0.86	0.84	0.99	0.97
	15	16	17	18	19	20	21	22	23	24	25	26	27	28
SE1	0.32**	0.29**	0.40**	0.37**	0.33**	0.34**	0.38**	0.29**	0.38**	0.29**	0.32**	0.34**	0.29**	0.25**
SE2	0.36**	0.37**	0.31	0.43**	0.39**	0.40**	0.46**	0.31**	0.37**	0.31**	0.37**	36**	0.36**	0.29**
SE3	0.37**	0.38**	0.32	0.44**	0.40**	0.43**	0.46**	0.31**	0.39**	0.39**	0.39**	0.35**	0.35**	0.35**
SE4	0.34**	0.33**	0.28	0.42**	0.38**	0.40**	0.45**	0.32**	0.36**	0.30**	0.39**	0.37**	0.39**	0.31**
SE5	0.35**	0.32**	0.32	0.44**	0.39**	0.38**	0.45**	0.29**	0.40**	0.37**	0.37**	0.38**	0.33**	0.31**
SE6	0.37**	0.36**	0.38	0.44**	0.42**	0.43**	0.47**	0.29**	0.42**	0.37**	0.38**	0.38**	0.35**	0.34**
SE7	0.35**	0.33**	0.27	0.43**	0.42**	0.42**	0.48**	0.33**	0.39**	0.34**	0.42**	0.38**	0.40**	0.35**
SE8	0.36**	0.36**	0.34	0.44**	0.41**	0.43**	0.48**	0.32**	0.42**	0.37**	0.39**	0.38**	0.32**	0.33**
TP1	0.22**	0.26**	0.24	0.49**	0.49	0.51**	0.47**	0.23**	0.35**	0.43**	0.32**	0.28**	0.25**	0.42**
TP2	0.26**	0.24**	0.21	0.57**	0.58**	0.59**	0.53**	0.28**	0.37**	0.46**	0.39**	0.30**	0.34**	0.45**
TP3	0.22**	0.18**	0.13	0.50**	0.52**	0.52**	0.50**	0.26**	0.34**	0.39**	0.37**	0.30**	0.31**	0.41**
SR1	0.45**	0.47**	0.37	0.42**	0.36**	0.39**	0.42**	0.28**	0.40**	0.34**	0.31**	0.34**	0.32**	0.32**
SR2	0.26**	0.30**	0.37	0.21**	0.18**	0.10**	0.20**	0.16**	0.24**	0.23**	0.21**	0.25**	0.15**	0.21**
SR3	0.42**	0.28**	0.39	0.32**	0.28**	0.29**	0.29**	0.19**	0.34**	0.35**	0.28**	0.29**	0.27**	0.30**
SR4	–	0.38**	0.32	0.39**	0.33**	0.33**	0.35**	0.28**	0.37**	0.31**	0.29**	0.30**	0.34**	0.27**
SR5		–	0.29	0.33**	0.32**	0.32**	0.32**	0.21**	0.27**	0.30**	0.30**	0.26**	0.27**	0.30**
SR6			–	0.27**	0.27**	0.26**	0.28**	0.24**	0.32**	0.32**	0.21**	0.26**	0.22**	0.24**
CP1				–	0.68**	0.70**	0.68**	0.37**	0.50**	0.55**	0.50**	0.43**	0.52**	0.54**
CP2					–	0.76**	0.66**	0.35**	0.44**	0.49**	0.45**	0.36**	0.40**	0.45**

Table 5 (continued)

	15	16	17	18	19	20	21	22	23	24	25	26	27	28
CP3						–	0.70**	0.35**	0.47**	0.52**	0.48**	0.35**	0.42**	0.47**
CP4							–	0.38**	0.48**	0.52**	0.61**	0.39**	0.48**	0.52**
Eng1								–	0.46**	0.39**	0.36**	0.35**	0.39**	0.31**
Eng2									–	0.55**	0.41**	0.49**	0.43**	0.43**
Eng3										–	0.46**	0.38**	0.46**	0.63**
Eng4											–	0.36**	0.50**	0.52**
Eng5												–	0.44**	0.35**
Eng6													–	0.51**
Eng7														–
Mean	3.59	3.84	4.01	3.72	3.74	3.77	3.72	3.50	3.75	3.94	3.60	3.43	3.37	3.81
SD	0.98	0.85	0.82	0.78	0.71	0.73	0.77	0.96	0.96	0.88	0.91	0.97	0.98	0.86

$^{**}p < 0.001$ $^{*}p < 0.05$

Table 6 Results of the fitness examination of the hypothesized model (n = 1,435)

	χ^2	*p*	*df*	*TLI*	*CFI*	*SRMR*	*RMSEA* (90% Confidence Interval)
Structural model	1866.454	0.000	341	0.930	0.937	0.042	0.056 (0.053 ~ 0.059)
Fit criteria	–		–	> 0.90	> 0.90	< 0.08	< 0.08

rejected. Self-regulation had a positive relationship with cognitive presence ($\beta = 0.246$, $t = 6.748$, $p < 0.001$) and learning engagement ($\beta = 0.279$, $t = 6.928$, $p < 0.001$). As a result, both H7 and H8 were supported. Finally, the positive relationship between cognitive presence and learning engagement was found ($\beta = 0.592$, $t = 12.705$, $p < 0.001$); thus, H9 was supported. Table 7 as well as Fig. 3 recap and help visualize the results stated above.

We investigated the direct, indirect, and total effects of self-efficacy for learning, self-regulation, and teaching presence on cognitive presence and learning engagement (see Table 8). Whereas the direct effects of self-efficacy on learning engagement were not significant ($\beta = 0.056$, ns), the indirect effects were significant ($\beta = 0.597$, $p < 0.05$). Therefore, the total effects of self-efficacy on learning engagement were significant ($\beta = 0.654$, $p < 0.05$). The indirect effects of self-efficacy (through teaching presence and self-regulation) on cognitive presence were statistically significant ($\beta = 0.417$, $p < 0.05$) along with the direct effects ($\beta = 0.212$, $p < 0.05$). Thus, the total effects were also significant ($\beta = 0.630$, $p < 0.05$). Notably, while teaching presence did not influence learning engagement directly ($\beta = 0.047$, *ns*), the indirect effects through cognitive presence were significant ($\beta = 0.314$, $p < 0.05$) along with the total effects ($\beta = 0.361$, $p < 0.05$). In addition, the direct effects of self-regulation on learning engagement were significant ($\beta = 0.279$, $p < 0.05$) and the indirect effects through cognitive presence were also significant ($\beta = 0.146$, $p < 0.05$).

Discussion

Online and blended forms of learning have become the new normal. As we progress into this new age of intensified technology-enhanced instruction with its heavy reliance of online formats, there undoubtedly will be considerable changes in the forms of learner

Table 7 Hypothesis testing results (N = 1435)

Hypothesis	*B*	Standard Path Coefficient β	*SE*	*t*-value
H1: SE → Teaching presence	0.335	0.448	0.022	15.458***
H2: SE → Self-regulation	0.579	0.729	0.027	21.119***
H3: SE → Cognitive presence	0.182	0.212	0.030	5.992***
H4: SE → Learning engagement	0.045	0.056	0.028	1.584
H5: Teaching presence → Learning engagement	0.050	0.047	0.032	1.540
H6: Teaching presence → Cognitive presence	0.607	0.531	0.030	20.585***
H7: Self-regulation → Cognitive presence	0.265	0.246	0.039	6.748***
H8: Self-regulation → Learning engagement	0.280	0.279	0.040	6.928***
H9: Cognitive presence → Learning engagement	0.551	0.592	0.043	12.705***

****p < 0.001*, ***p < 0.01*, **p < 0.05*

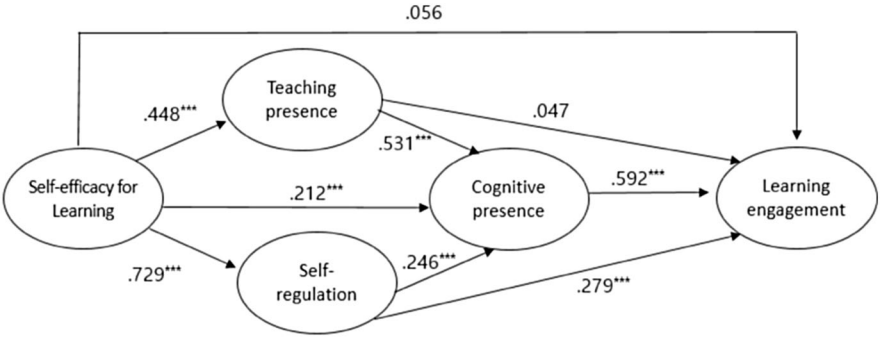


Fig. 3 Hypothesis testing results. ***$p < 0.001$, **$p < 0.01$, *$p < 0.05$

Table 8 Comparisons of direct, indirect, and total effects of the variables (N = 1435)

Hypothesis	Total effects	Direct effects	Indirect effects
H1: SE → Teaching presence	0.448*	0.448*	–
H2: SE → Self-regulation	0.729*	0.729*	–
H3: SE → Cognitive presence	0.630*	0.212*	0.417*
H4: SE → Learning engagement	0.654*	0.056	0.597*
H5: Teaching presence → Learning engagement	0.361*	0.047	0.314*
H6: Teaching presence → Cognitive presence	0.531*	0.531*	–
H7: Self-regulation → Cognitive presence	0.246*	0.246*	–
H8: Self-regulation → Learning engagement	0.425*	0.279*	0.146*
H9: Cognitive presence → Learning engagement	0.592*	0.592*	–

engagement utilized by instructors in these online courses in their attempts to create engaging and interactive environments for successful learning. In particular, blended or hybrid environments are proliferating with many educational institutions and organizations espousing a HyFlex approach (Beatty, 2019) as well as dozens of other blended learning frameworks, models, and approaches (Bonk & Graham, 2006; Graham, 2022; Vaughan, 2022).

Given this increasingly unique and pedagogically powerful learning environment, it is worthwhile to investigate and compare the influence of key variables found in such an environment on learning engagement. Accordingly, the purpose of this study was to examine the relationships of self-efficacy, self-regulation, teaching presence, and cognitive presence with learning engagement. Importantly, there were several key research findings uncovered by this investigation. First, this study found that self-efficacy for learning had positive relationships with three variables: self-regulation, teaching presence, and cognitive presence. However, self-efficacy had only an indirect relationship with learning engagement. That is, the relationship between self-efficacy and learning engagement was fully mediated through self-regulation, teaching presence, and cognitive presence.

Self-efficacy has been extensively studied in education as a predictor of learning outcomes, goal achievement, and learning engagement (Huang, 2016; Tsai et al., 2011). Recent research findings have reported effects of self-efficacy on learning engagement in online learning environments during COVID-19, including She et al. (2021) and El-Sayad

et al. (2021). However, this study did not support these previous research findings; instead, we only found indirect effects of self-efficacy on learning engagement. Specifically, we found that self-efficacy itself did not enhance learning engagement. Self-efficacy influenced learning engagement only when individuals' have sufficient self-regulation, and/or perceive teachers' efforts or activities to help them learn (i.e., teaching presence), and/or when they construct or understand meaning (i.e., cognitive presence) in online learning environments. Thus, instructors should make concerted attempts to improve students' self-regulation as well as teaching presence and cognitive presence to enable self-efficacy to influence or enhance learning engagement and learning achievement. Those who have high self-efficacy may not succeed in learning without sufficient self-regulation or proper support from instructors in online learning environments. Students who have limited opportunities to meet instructors and peers in person during the pandemic may need to have more supports for self-regulating and engaging their learning from instructors. Instructors should recognize the importance of influencing factors (i.e., self-regulation, teaching presence, and cognitive presence) to enhance the effects of self-efficacy on learning engagement.

Another main finding is that teaching presence had a positive relationship with cognitive presence, which supports previous research findings (e.g., Akyol & Garrison, 2008; Archibald, 2010; Garrison et al., 2010; Ke, 2010; Kozen & Richardson, 2014; Shea & Bidjerano, 2009; Yang et al., 2016). However, we found no direct relationship between teaching presence and learning engagement, which contradicts the research findings of El-Sayad et al. (2021). In the present study, teaching presence had an indirect relationship with learning engagement through cognitive presence. Anderson et al. (2001) defined teaching presence as "the design, facilitation, and direction of cognitive and social processes for the purpose of realizing personally meaningful and educationally worthwhile learning outcomes" (p.5). Caskurlu et al. (2020), Shea and Bidjerano (2009), and Swan et al. (2009) explained that the role of teaching presence is to help or facilitate learning outcomes by enhancing cognitive presence and social presence. Their findings have provided profound insights into both online teaching and learning.

We also found that cognitive presence had a direct impact on learning engagement. This key finding confirms previously reported research explaining that the role of cognitive presence helps students achieve learning goals or outcomes, which is an essential component of critical thinking (Cho et al., 2017; Garrison et al., 2000; Yang et al., 2016). This study also supported the findings of studies highlighting the importance of cognitive presence to achieve successful learning outcomes at the university level (Kozen & Richardson, 2014; Vaughan & Garrison, 2005). Given that we measured students' learning engagement as an essential condition for learning outcomes, our findings were more closely aligned with Akyol and Garrison's (2011) results which revealed that cognitive presence contributes to perceived (subjective) learning as well as actual (objective) learning outcomes. In addition, we found that cognitive presence plays a critical role in mediating the relationship between teaching presence and learning engagement (full mediation), and between self-regulation and learning engagement (partial mediation).

Last, self-regulation had a positive relationship with both cognitive presence and learning engagement in this study. This study supported Cho et al.'s (2017) research findings indicating that highly self-regulated learners exhibited a stronger sense of CoI (i.e., cognitive, teaching, and social presence) than low self-regulated learners. In addition, these results emphasize the important role of self-regulation on CoI as investigated by Kilis and Yıldırımb (2018). This finding also highlights the self-regulation challenges students face in the online component of blended learning, which supports Rasheed et al.'s (2020) earlier findings. Instructors should recognize the importance of

self-regulation in online learning because interactions between instructors and students typically decrease in online learning environments.

Practical implications

The research findings of this study provide practical implications to instructors, instructional designers, school administrators, and other educators across all sectors. This study emphasized the significance of cognitive presence in terms of the mediating role of the relationship between teaching presence, self-regulation, and learning engagement as well as the direct effects on learning engagement. This finding implies that instructors and school administrators should make efforts to enhance students' cognitive presence for promoting learning engagement.

Given that learning involves changes in learners (i.e., performance capacity) (Driscoll, 1994), instructors should consistently monitor students' cognitive presence, in terms of how students learn and how they perceive their learning process (Garrison et al., 2000). Obviously, what instructors do to improve students' learning (i.e., teaching presence) is important; however, teaching presence itself was not strong enough in this study to improve learning engagement. Based on our study results, however, teaching presence will be expected to enhance students' learning engagement when cognitive presence is exhibited; for example, when students construct and negotiate meaning through various forms of communication and reflection as well as when they continue to monitor and evaluate their overall learning progress. Our results indicate that instructors' roles and responsibilities extend far beyond their pedagogical innovations and assessments to include monitoring students' learning progress, providing scaffolding if and when necessary, and facilitating learner reflection on their performances.

This study also underlined the importance of self-regulation. Self-regulation enables students to achieve learning goals or desirable learning outcomes by monitoring, regulating, and controlling their behaviors (Pintrich, 2000). In online learning environments, it is hard to expect students who are lacking in sufficient self-regulatory skills and competencies to succeed in learning. Simply put, self-regulation is required to fully appreciate and take advantage of the high degree of learner autonomy often found in online learning environments. However, too often students are not equipped with sufficient self-regulatory skills; which, as explained earlier, are a prerequisite for the success of online learning courses and programs. To help online students with low self-regulatory skill or experience, it may be prudent to diagnose their self-regulation level at the beginning of semester and provide appropriate instructional assistance or scaffolding, if necessary. In addition, when deemed needed, instructors should teach self-regulation strategies and provide opportunities to practice self-regulation as an orientation program near the beginning of a semester or when entering an online learning degree program.

Limitations and further direction

This study has several limitations and constraints. First, we collected quantitative data which relied solely on student surveys. Future researchers who want to extend the current research scope and findings might adopt a mix-method research design to attempt to obtain more detailed and potentially vivid research findings. A few brief email interviews

we collected informally after the study indicated that it was difficult for these undergraduate students to study on their own at home without the direct support of an instructor or interactions with their peers to guide them and create consistent study patterns and explicit learning goals. These personal communications mentioned that, in the past, studying with their peers kept them on track and made them work harder. This brief sampling of students signals that it is necessary to collect data from various sources, such as extended observations, in-depth one-to-one interviews, and follow-up focus groups. In addition, it is highly plausible that readily accessible computer log data and asynchronous conferencing discourse can supplement such observations and interviews.

A second key limitation relates to the study population. Although the sample size of this study is quite large (N = 1,435), the participants were fairly homogenous in terms of race/ethnicity, nationality, and social and cultural background due to the fact that they were all enrolled in a single university in Korea. To improve the generalization of these research findings, it is necessary to invite participants from more diverse populations and regions of the world (Jung, 2014; Phan, 2018). Such an extension is particularly crucial as online educational opportunities are extended throughout the planet from the Global North to the Global South (Krasny et al., 2020; Zhang et al., 2020). More diverse samples are also vital as the challenges and issues of diversity, equity, and inclusion have received intense scrutiny and attention in technology-enhanced learning environments. Fortunately, this scrutiny has resulted in much needed inroads in educational policies, initiatives, guidelines (Gunawardena et al., 2019; Gunawardena, 2020; OECD, 2020), and innovations in pedagogical practices (Krasny et al., 2020; Phan, 2018).

During the past couple of decades, there has been extensive interest in and attention given to teaching presence, social presence, and cognitive presence (Garrison et al., 2010; Swan & Ice, 2010). However, the results of this study indicate that much more still needs to be done. Given the recent expansion of fully online and blended learning during the COVID-19 pandemic, there is a pressing need to better understand the relationships between self-efficacy, self-regulation, teaching presence, and cognitive presence as well as to understand the impact of these variables on learning engagement.

As such, there are numerous directions and next steps for studies in this area. In terms of future directions, the same model utilized in the present study could be employed during the next few years to determine if the results hold in a post pandemic world. In effect, researchers would be asking if instructors revert back to traditional teaching methods. At the same time, a different model or framework could be utilized in a follow-up study to extend the current research; especially, as a post pandemic society brings unique teaching and learning situations.

Highly interesting and informative research might compare learner and instructor perceptions of teaching presence, social presence, and cognitive presence and how the matches and mismatches of these perceptions affect learning engagement and performance. Researchers could also explore instructor pedagogical philosophies in relation to not only the design of blended and fully online courses (Voegele, 2014), but how these courses can help establish teaching, social, and cognitive presence. Alternatively, one could investigate the specific pedagogical techniques employed that might elevate learner self-efficacy, engagement, and successful course completion. Such research is bound to provide timely and important insights into effective online teaching and learning practices.

Appendix A: Measurement items used in this research

Self-efficacy for learning (8 items)

1. I believe I will receive an excellent grade in this class.
2. I'm certain I can understand the most difficult material presented in the readings for this course.
3. I'm confident I can understand the basic concepts taught in this course.
4. I'm confident I can understand the most complex material presented by the instructor in this course.
5. I'm confident I can do an excellent job on the assignments and tests in this course.
6. I expect to do well in this class.
7. I'm certain I can master the skills being taught in this class.
8. Considering the difficulty of this course, the teacher, and my skills, I think I will do well in this class.

* Adapted from Pintrich et al. (1991)

Self-regulation (6 items)

1. I ask myself questions to make sure I know the material I have been studying.
2. When work is hard I either give up or study only the easy parts.
3. Even when study materials are dull and uninteresting, I keep working until I finish.
4. Before I begin studying, I think about the things I will need to do to learn.
5. When I'm reading, I stop once in a while and go over what I have read.
6. 1 work hard to get a good grade even when I don't like a class.

* Adapted from Pintrich and Groot. (1990)

Teaching presence (13 items)

[Design & organization]

1. The instructor clearly communicated important course topics.
2. The instructor clearly communicated important course goals.
3. The instructor provided clear instructions on how to participate in course learning activities.
4. The instructor clearly communicated important due dates/time frames for learning activities.

[Facilitation]

5. The instructor was helpful in identifying areas of agreement and disagreement on course topics that helped me to learn.
6. The instructor was helpful in guiding the class towards understanding course topics in a way that helped me clarify my thinking.
7. The instructor helped to keep course participants engaged and participating in productive dialogue.

8. The instructor helped keep the course participants on task in a way that helped me to learn.
9. The instructor encouraged course participants to explore new concepts in this course.
10. Instructor actions reinforced the development of a sense of community among course participants.

[Direct Instruction]

11. The instructor helped to focus discussion on relevant issues in a way that helped me to learn.
12. The instructor provided feedback that helped me understand my strengths and weaknesses relative to the course's goals and objectives.
13. The instructor provided feedback in a timely fashion.

* Adapted from Arbaugh et al. (2008).

Cognitive presence (12 items)

[Triggering event]

1. Problems posed increased my interest in course issues.
2. Course activities piqued my curiosity.
3. I felt motivated to explore content related questions.

[Exploration]

4. I utilized a variety of information sources to explore problems posed in this course.
5. Brainstorming and finding relevant information helped me resolve content related questions.
6. Online discussions were valuable in helping me appreciate different perspectives.

[Integration]

7. Combining new information helped me answer questions raised in course activities.
8. Learning activities helped me construct explanations/solutions.
9. Reflection on course content and discussions helped me understand fundamental concepts in this class.

[Resolution]

10. I can describe ways to test and apply the knowledge created in this course.
11. I have developed solutions to course problems that can be applied in practice.
12. I can apply the knowledge created in this course to my work or other non-class related activities.

: * Adapted from Arbaugh et al. (2008).

Learning engagement (7 items)

1. I often discuss with my friends what I'm learning in class.
2. I regularly participate in class discussions in most of my classes.
3. I feel as though I am learning things in my classes that are worthwhile to me as a person.
4. I can usually find ways of applying what I'm learning in class to something else in my life.
5. I ask my professors questions during class if I do not understand.
6. I find myself thinking about what I'm learning in class even when I'm not in class.
7. I feel energized by the ideas that I am learning in most of my classes.

* Adapted from Schreiner and Louis (2011)

Acknowledgements Not applicable

Funding The authors declare that we have no funding source for this research.

Declarations

Conflict of interest The authors declare that they have no conflict of interest.

Data availability The data used and/or analyzed in the current study are available from the author upon request.

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