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INVESTIGATING RELATIONSHIPS: SELF-EFFICACY, SELF-REGULATION, TEACHING, COGNITIVE PRESENCE, AND LEARNING ENGAGEMENT AMIDST COVID-19

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Abstract: During the pandemic, this research looked at the connections between instructional presence, cognitive presence, learner engagement, and self-efficacy and self-regulation. 1435 Korean undergraduate students in total responded to an online survey on their COVID-19 learning experiences. The results show that instructional presence, cognitive presence, and self-regulation were all positively correlated with self-efficacy. Self-regulation, teaching presence, and cognitive presence all completely moderated the link between self-efcacy and learning engagement; no direct association between the two was discovered. Learning engagement and cognitive present were positively correlated with self-regulation. Cognitive presence was positively impacted by teaching presence, but learner engagement was not affected. But the association between teaching presence and learner engagement was entirely mediated by cognitive presence. Overall, this research provides evidence in favor of the importance of cognitive presence in online learning.

Keywords: community of inquiry (coi) • self-regulation • teaching presence • cognitive presence • learning engagement • COVID-19

I. 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 diferent 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' eforts 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

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"the extent to which learners are able to construct and confrm meaning through sustained refection 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 efectiveness of online classes and learning communities. Online classes have diferent 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 efective 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 selfreliantly 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 faceto-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 efects of self-regulation and teaching presence on learning outcomes, including learning engagement. In response, this paper examined the efects of self-efcacy, self-regulation, teaching presence, and cognitive presence on learning engagement during COVID-19.

II. Literature review

The theoretical framework of this study includes: (1) the community of inquiry (coi) framework, (2) self-efcacy, and (3) self-regulation theory. The coi framework, which is based on social constructivism and heavily infuenced by Dewey's practical inquiry, was Examinations of the relationships between self-efcacy,… 483 1 3 initially introduced by Garrison et al. (2000) (Swan & Ice, 2010). During the COVID-19 pandemic, self-efcacy 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.

Community of inquiry (coi) framework

Garrison (2011) defned 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 &

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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 infuences 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 fnally 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 fulfll learning goals (e.g., active discourse or knowledge construction), it is an infuencing 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

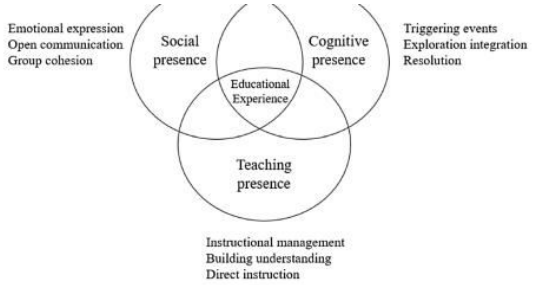

Fig. 1 Community of Inquiry. *Note.* Adapted from Fig. 1. Elements of an educational experience (Garrison et al., 2000, p. 88)

efective 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

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expertise to encourage student refection and facilitate efcient discourse by questioning, scafolding, 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 signifcant direct and total efect on cognitive presence, while social presence has only a signifcant direct efect on cognitive presence. Yang et al. (2016) also reported similar fndings that the infuence 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 efect sizes from 30 studies and the overall fndings indicated a strong relationship between teaching presence and satisfaction and perceived learning. Specifcally, 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 efect 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 efects 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 fndings confrm the signifcant infuence 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-efcacy, and coi

Zimmerman and Schunk (2011) defned self-regulation as "the processes whereby learners personally activate and sustain cognitions, afects, 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

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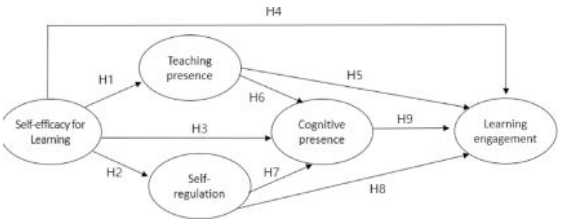
their cognition, motivation, and behavior, guided and constrained by their goals and the contextual features of the environment" (p. 453). In the same vein, Cho et al. (2017) listed four qualities of self-regulated learners: (1) intrinsic orientation, (2) high confdence in learning, (3) high control of learning beliefs, and (4) high task values. High confdence in learning is pertinent to self-efcacy, which is defned as "beliefs in one's capabilities to organize and execute the courses of action required to produce given attainments" (Bandura, 1997, p. 3). Self-efcacy 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-efcacy have reported that the efects of self-efcacy 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 efects of self-efcacy, 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-efcacy infuenced behavioral and emotional engagement but not cognitive engagement during the pandemic. Importantly, teaching presence afected 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-efcacy, student engagement, and online learning satisfaction during COVID-19. Importantly, they discovered that interaction afected self-efcacy, student engagement, and online learning satisfaction. She et al., (2021) also found that self-efcacy positively infuenced student engagement but negatively afected online learning satisfaction.

III. 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 ofcially allow instructors to deliver courses online. However, due to the pandemic, more than 50% of courses were delivered through online means in 2021. More specifcally, 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

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engagement. H9: Cognitive presence has a positive relationship with learning engagement. Three types of courses: (1) fully online classes, (2) blended classes, and (3) onsite classes. The selected class format was refective 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-efcacy 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, feld 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-efcacy was adopted from Pintrich et al.'s (1991) Motivated Strategies for Learning Questionnaire (MSLQ). Self-efcacy 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 fnd that I have been reading for class but don't know what it is all about," and "I fnd 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

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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."

IV. Data analysis

We applied structural equation modeling (SEM) to examine the relationships between self-efcacy, self-regulation, teaching presence, cognitive presence, and learning engagement. Prior to conducting structural equation modeling, confrmatory 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 fve primary variables, item parceling was conducted for statistical purposes, which is a widely used multivariate approach. Little et al. (2002) defned 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-efcacy, 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 confrmed that the factor loadings, AVE, and CR values of the data were acceptable (Fornell & Larcker, 1981) (see Table 2).

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 ft 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.

V. 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-efcacy 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

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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

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					–

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

In Table 4, the correlations among the variables were all signifcant at p<0.001.

Hypothesis testing Prior to examining the hypotheses, the good of ftness of the hypothesized model was estimated. As shown in Table 6, the hypothesized model indicated a fair ft to the data ($\chi2$=1866.454; df=341; $\chi2$ /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 ft between the proposed model and the data. As for the RMSEA value, below 0.05 indicates a close ft, 0.08 is a fair ft, and 0.10 is a borderline ft. A range from 0 and 0.08 of SRMR values is considered acceptable (Hu & Bentler, 1999). The fndings indicated that self-efcacy for learning had a positive relationship with teaching presence (β=0.448, t=15.458, p

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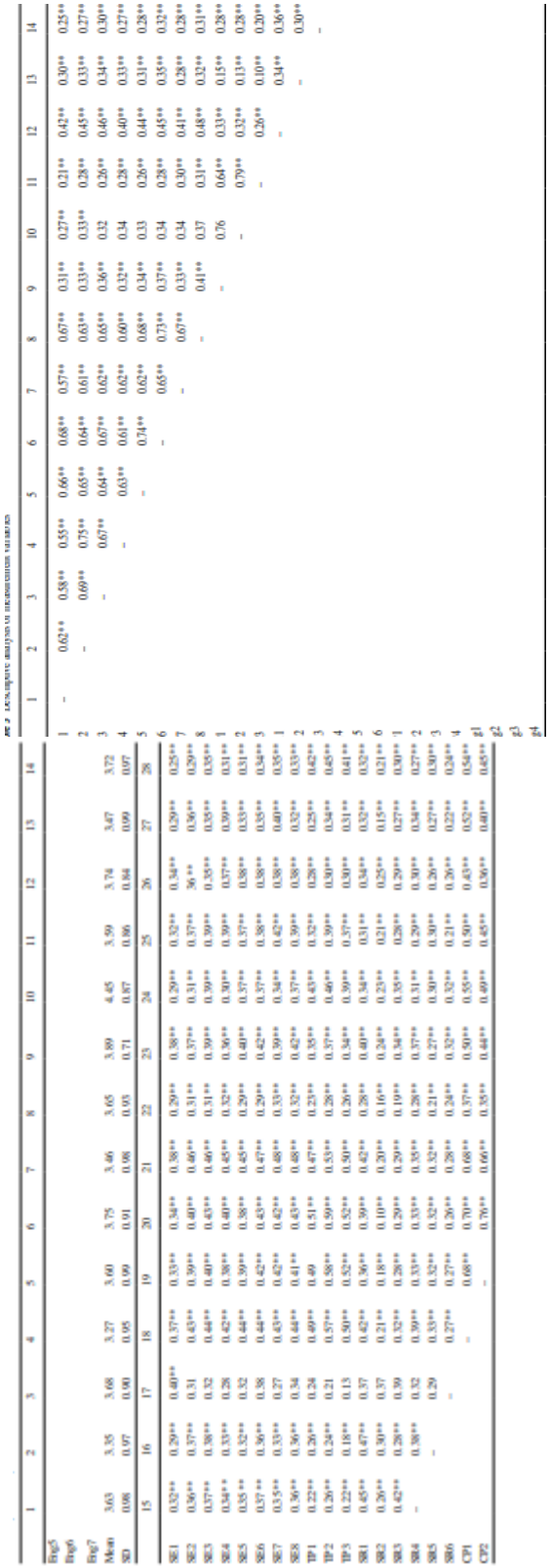

Table 5 (continued)

	15	16	17	18	19	20	21	22	23	24	25	26	27	28
CP3						-	0.70**	0.55**	0.47**	0.52**	0.48**	0.35**	0.42**	0.47**
CP4							-	0.58**	0.48**	0.52**	0.61**	0.39**	0.48**	0.52**
Eng1								-	0.66**	0.59**	0.56**	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	0.75	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 (β=0.246, t=6.748, p<0.05).

Discussion

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

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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***

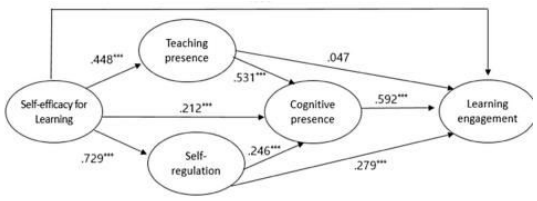

Fig. 3 Hypothesis testing results. ***$p < 0.001$, **$p < 0.01$, *$p < 0.05$

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 infuence of key variables found in such an environment on learning engagement. Accordingly, the purpose of this study was to examine the relationships of self-efcacy, self-regulation, teaching presence, and cognitive presence with learning engagement. Importantly, there were several key research fndings uncovered by this investigation. First, this study found that self-efcacy for learning had positive relationships with three variables: self-regulation, teaching presence, and cognitive presence. However, self-efcacy had only an indirect relationship with learning engagement. That is, the relationship between self-efcacy and learning engagement was fully mediated through self-regulation, teaching presence, and cognitive presence. Self-efcacy 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 fndings have reported efects of self-efcacy on learning engagement in online learning environments during COVID-19, including She et al. (2021) and El-Sayad**.**

Practical implications

The research fndings of this study provide practical implications to instructors, instructional designers, school administrators, and other educators across all sectors. This study emphasized the signifcance 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 efects on learning engagement. This fnding implies that instructors and school administrators should make eforts 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.,

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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 refection 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 scafolding if and when necessary, and facilitating learner refection 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 sufcient 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 sufcient 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 scafolding, 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.

VI. 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 fndings might adopt a mix-method research design to attempt to obtain more detailed and potentially vivid research fndings. A few brief email interviews.

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