Exploring the Relationship Between Teaching Presence, Self-Regulation, and Co-Regulation in Online Courses

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Abstract
This study explores the relationship between teaching presence and students' self- and co-regulation, in online learning courses. Data were collected from 283 students enrolled in online courses using the Teaching Presence Scale of the Community of Inquiry survey and a Shared Metacognition Questionnaire. Descriptive analyses revealed that students perceived their instructor's course design practices, particularly clear communication of goals, deadlines, and instructions, as the most influential component of teaching presence in enhancing their learning experiences. Students reported strong self-regulation, especially in maintaining awareness of effort and motivation. For co-regulation, while students recognized the importance of considering and listening to peer feedback, the greater variability in these ratings suggested differing levels of value placed on these collaborative practices. Regression analyses showed that both course design and facilitation significantly predicted self-regulation, explaining 25.9% of its variance, whereas facilitation alone predicted co-regulation, accounting for 26% of its variance. These findings emphasize the importance of intentional course design and active facilitation in fostering self-regulation and co-regulation in online courses. The study contributes to advancing the Community of Inquiry framework by integrating metacognitive constructs and offers actionable strategies for designing online courses that promote autonomy and shared responsibility for learning.

Keywords: Online courses, teaching presence, self-regulation, co-regulation, regulated learning

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As online education continues to expand, educators and researchers are increasingly focused on designing learning environments that cultivate students' sense of presence and enhance their ability to regulate learning effectively (Liao et al., 2023; Maré & Mutezo, 2025). Yet, instructors struggle with issues of quality due to the "requirement of higher-level self-directed learning skills and greater difficulties in enabling effective human interactions" (Xu & Xu, 2019, p. 26). To enhance the quality of online learning for students, it is important to use strategies that can support the development of students' regulatory processes in shared learning environments (Garrison, 2022). The Community of Inquiry (CoI) framework offers a foundation for developing such environments, emphasizing the interplay of cognitive presence, teaching presence, and social presence to support meaningful learning experiences (Garrison et al., 2010).

Among the CoI elements, teaching presence plays a vital role in shaping learner engagement and fostering regulated learning (Akyol, 2013; Garrison et al., 2000). Defined as "the design, facilitation, and direction of cognitive and social processes to realize personally meaningful and educationally worthwhile learning outcomes" (Anderson et al., 2001, p. 5), teaching presence has been linked to the development of both self-regulation (SR) and co-regulation (CoR). SR refers to learners' ability to plan, monitor, and evaluate their cognitive and motivational processes (Hadwin et al., 2017) while CoR involves collaborative efforts to manage learning through shared strategies and peer support (Järvelä et al., 2018).

In online learning contexts, where face-to-face is often absent, students must rely on self-regulatory skills such as goal setting, time management, and self-monitoring to navigate their learning independently (Doo et al., 2023). Simultaneously, CoR becomes essential for sustaining motivation and deepening understanding through peer interaction and shared metacognitive practices (Garrison & Akyol, 2015). Teaching presence fosters both SR and CoR, which together drive better engagement, satisfaction, and achievement (Doo et al., 2023; Garrison, 2022). Illuminating which aspects of teaching presence most effectively strengthen students' SR and CoR can guide practitioners to prioritize design features and facilitation strategies that enhance learner autonomy, collaboration, and ultimately course success (Broadbent & Fuller-Tyszkiewicz, 2018; Shea & Bidjerano, 2024).

While the importance of a strong teaching presence is recognized, limited research has examined its relationship with student-driven behaviors like SR and CoR of learning (Maré & Mutezo, 2025). There is a growing need to explore how teaching presence influences students' awareness and use of regulatory strategies, and how these perceptions relate to learning outcomes in online environments (Garrison, 2022; Sadaf et al., 2022). Specifically, understanding the relationship between teaching presence and regulation can inform course design and instructional practices that better support regulated learning in online environments (Garrison & Akyol, 2015; Maré & Mutezo, 2025).

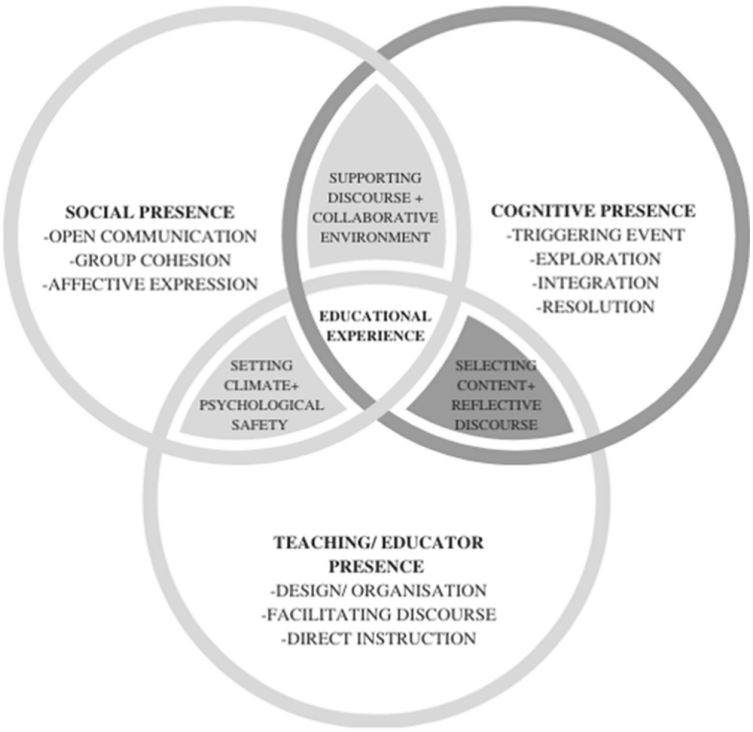
Theoretical Framework

This study is grounded in the Community of Inquiry (CoI) framework (see Figure 1) developed by Garrison, Anderson, and Archer (2001), which provides a robust model for designing and evaluating online learning environments through a social-constructivist lens (Castellanos-Reyes, 2020; Garrison, 2017; Swan, Garrison, & Richardson, 2008). The CoI

framework posits that meaningful learning occurs at the intersection of three core elements: cognitive presence, social presence, and teaching presence (Garrison et al., 2000). Social presence is about participants' social interaction in online learning environments, and cognitive presence guides the construction of meaning through reflection and discourse (Garrison et al., 2001). Teaching presence focuses on the design, facilitation, and direction of social and cognitive presence to achieve desired learning outcomes (Anderson et al., 2001).

Figure 1

Community of Inquiry Framework (Garrison et al., 2001)



Recent developments in the CoI framework highlight the role of metacognition, particularly SR and CoR, as residing between teaching and cognitive presence (Garrison, 2022). This intersection reflects the synergy between internal knowledge construction and collaborative learning activities. For example, cognitive presence supports the development of metacognitive skills through inquiry and reflection, while social presence creates a motivational climate that encourages regulatory behaviors. Teaching presence, in turn, fosters regulation by guiding learners to take personal responsibility for their learning and by facilitating collaborative knowledge building (Garrison, 2022). Each component of teaching presence contributes uniquely to regulatory development:

- Design and organization provide a structured environment for critical reflection and discourse, serving as a metacognitive map of the learning process.

- Facilitation supports the implementation of metacognitive strategies during learning activities.

- Direct instruction enhances collaborative learning by promoting awareness and management of learning processes, which can lead to improved academic performance (Garrison, 2022).

Garrison et al. (2010) emphasize that teaching presence is essential for establishing and sustaining the cognitive and social processes that underpin metacognition. Vuopala et al. (2019) found that prompting regulation activities—such as task-related monitoring—can help students engage in regulatory processes that support high-level knowledge co-construction. The CoI framework was selected for this study because it emphasizes both the personal (reflective) and shared (collaborative) dimensions of the learning experience (Garrison et al., 2001). It offers a comprehensive lens through which to examine the relationship between teaching presence and students' regulation in online learning environments (Garrison, 2022).

Literature Review

With the rapid expansion of online education, understanding the pedagogical strategies that foster meaningful learning experiences has become a priority for educators and researchers alike. Among the most well-established theoretical frameworks guiding this understanding is the Community of Inquiry (CoI) framework, which posits that the development of deep and meaningful online learning experiences relies on the interaction of three core elements: cognitive presence, social presence, and teaching presence (Garrison et al., 2000). Teaching presence, in particular, has garnered significant attention for its critical role in shaping students' learning outcomes by structuring the learning environment, supporting engagement, and guiding the learning process (Lowenthal & Dunlap, 2020).

Teaching Presence in Online Learning

Teaching presence, as defined within the Community of Inquiry (CoI) framework, encompasses three core components: instructional design and organization, facilitating discourse, and direct instruction (Anderson et al., 2001). Together, these elements contribute to a structured and supportive learning environment that fosters both cognitive engagement and social interaction. A robust teaching presence has been consistently linked to higher levels of student satisfaction, engagement, and perceived learning outcomes (Martin et al., 2018).

Recent research has underscored the critical role of instructional design in establishing clear expectations and guiding learners through the educational process (Anderson et al., 2001). Johnson et al. (2017) noted that the structure and organization of online courses play a critical role in promoting meaningful learning by fostering student motivation and encouraging task completion. Poorly designed courses can result in cognitive overload and disengagement, whereas well-structured courses promote learner autonomy, focus, and self-monitoring (Jaggars & Xu, 2016). For example, Chen and Chen (2025) found that teaching presence—which integrates explicit instruction with structured guidance—significantly enhances student engagement and cognitive presence. Similarly, Sadaf et al. (2023) found that students rated

course design elements, such as clearly communicated goals and timelines, more favorably than facilitation or direct instruction.

Facilitation, the second component of teaching presence, involves encouraging student participation, maintaining engagement, and fostering a collaborative learning environment (Anderson et al., 2001). Effective facilitation includes prompting discussion, validating student contributions, and modeling critical thinking—practices that strengthen both social and cognitive presence (Stenbom, 2018). In the context of regulated learning, facilitation plays a vital role in supporting the co-construction of knowledge by guiding learners to reflect on their thinking and respond to peer feedback (Garrison, 2022). Sadaf et al. (2023) further highlighted that facilitation significantly predicts both SR and CoR, suggesting that instructors who actively engage in facilitating discourse can meaningfully influence students' metacognitive development.

The third element, direct instruction, involves delivering content expertise, clarifying misconceptions, and synthesizing key concepts (Anderson et al., 2001). While its primary function is to ensure content accuracy and coherence, direct instruction also contributes to metacognitive development by modeling critical thinking and problem-solving strategies (Akyol & Garrison, 2011; Garrison & Akyol, 2015). However, its influence on metacognitive engagement may be less pronounced compared to instructional design and facilitation. Nonetheless, when integrated effectively, direct instruction can support learners in developing the cognitive tools necessary for reflective and strategic learning (Garrison & Akyol, 2015).

While strong teaching presence is associated with enhanced perceived learning and improved educational experiences, limited research exists on how students perceive the effectiveness of different strategies used to establish teaching presence in online learning environments (Watson et al., 2023). Vaughan and Wah (2020) concluded that teaching presence should "intentionally design, facilitate, and direct a collaborative constructive learning environment in order for students to learn how to co-regulate their learning" (p.1). This suggests to a need for research on exploring students' perceptions of the effectiveness of various instructional strategies for establishing teaching presence in online environments that support collaborative and co-regulated learning.

Self-Regulation and Co-Regulation in Online Learning

Scholarly research consistently demonstrates a strong relationship between regulated learning and online learning performance (Tsai et al., 2018; Zhao & Ye, 2020). While SR focuses on individual goal-setting and strategy use, CoR refers to the mutual regulation of learning processes among peers, typically within collaborative learning environments (Järvenoja et al., 2025). Together, these processes form the foundation of CoR learning, which is especially critical in online learning contexts where students often work independently or in small groups to navigate complex tasks. Kizilcec et al. (2017) emphasized that regulatory strategies—such as planning, monitoring, and evaluating one's learning—enhance goal-setting and improve learning outcomes.

Self-regulated learning (SRL) refers to a dynamic process in which learners actively and intentionally engage in setting learning objectives, while simultaneously monitoring and regulating their motivation, cognitive strategies, and behaviors in alignment with both their goals

and the contextual demands of the learning environment (Pintrich, 2000). Students with strong SRL skills are more likely to persist through challenges, remain engaged, and employ effective learning strategies (Broadbent & Poon, 2015). Snyder and Dringus (2014) found that effective instruction, motivation, and guidance are essential for fostering regulation and the co-construction of knowledge in online courses. Similarly, Morrison and Jacobsen (2023) concluded that enhanced teaching presence through timely, strengths-based and personalized feedback had the effect of supporting students' self-regulation—the development of learner agency—and therefore enhancing students' engagement and learning in an online course. Garrison (2022) highlighted that intentional planning for collaborative learning, the establishment of a learning community, and the promotion of reflection and discourse can significantly enhance metacognitive development. While these studies offer valuable insights into the determinants of regulation, there remains a gap in understanding how to effectively teach students to become more aware of and capable in regulating their learning processes in online environments.

CoR extends the concept of SR to collaborative contexts, where learners engage in CoR by monitoring and supporting each other's learning (Järvelä et al., 2018). Hadwin et al. (2017) describe CoR as a social process that involves motivation, setting goals, and assessing progress, all of which take place within the context of interactions with others and the support available in the surrounding social environment. This includes behaviors such as giving and receiving feedback, reflecting on group progress, and adapting strategies based on peer input. Chen and Chen (2025) demonstrated that CoR, when supported by distributed teaching presence, leads to higher levels of cognitive engagement and improved learning outcomes. According to Garrison (2017), the development of SR and CoR is influenced by several factors, including the quality of instructional design, the availability of structured collaboration opportunities, and the instructor's role in facilitating meaningful discourse. Garrison (2022) further emphasized the importance of instructional strategies that intentionally promote regulation and collaborative learning in online settings. These strategies include guided reflection, peer assessment, and structured discussion prompts that encourage students to articulate their thinking and respond to others. Such approaches not only support individual learning but also cultivate a shared responsibility for learning within the group, ultimately enhancing the overall effectiveness of online education (Garrison, 2017).

Reflection and discourse with SR and CR can inform students how they can improve their approach to learning (Garrison, 2022). Studies have examined metacognitive processes in collaborative learning contexts recognizing the importance of individual and social regulatory processes within a community of inquiry (Kilis & Yildirim, 2018; Koehler et al., 2020). A collaborative learning environment requires more engaged approaches to help learners construct new meaning and share understanding with others (Garrison & Akyol, 2015). Therefore, Garrison (2022) emphasized the importance of exploring shared learning environments and strategies that can support the development of students' regulatory processes.

Relationship Between Teaching Presence, Self-Regulation, and Co-Regulation

Strong teaching presence can significantly enhance metacognitive engagement by fostering a supportive learning environment that promotes reflection, dialogue, and SR. Facilitation strategies—such as the use of guiding questions, peer feedback, and the encouragement of perspective-taking—have been shown to support CoR by promoting

interaction and responsiveness among learners (Stenbom, 2018; Sadaf et al., 2023). Kizilcec et al. (2017) found that instructional interventions aimed at enhancing regulated monitoring—such as goal-setting prompts and reflective checkpoints—can lead to increased learner engagement and improved performance in online courses. Similarly, Wang and Liu (2019) found that "the design and organization, as well as facilitating discourse, can facilitate students' interaction, reduce the number of peripheral students, and facilitate students' collaborative knowledge construction, especially in the knowledge sharing, discovery, discussion, and application" (p. 370). These findings underscore the importance of instructional strategies that go beyond content delivery to actively support students in managing their own learning processes. When students perceive a high level of teaching presence, they are more likely to engage in reflective practices and collaborate effectively with peers (Garrison, 2011; Garrison & Akyol, 2015). This highlights the need for instructors to be intentional in their *course design* and *facilitation*, ensuring that learners are equipped with the necessary tools and guidance to regulate their learning effectively.

Although prior research has demonstrated a strong association between students' perceived teaching presence and learning outcomes in online courses (Caskurlu et al., 2020), there remains a notable gap in the literature regarding the relationship between the three presences—teaching, social, and cognitive—and regulated learning in online environments. For instance, Sadaf et al. (2022) investigated students' perceptions of SR and CoR in relation to online presence within a case-based course. Their findings indicated that teaching presence did not exhibit a statistically significant relationship with regulation, suggesting that students who perceived higher teaching presence were not necessarily more likely to demonstrate higher levels of regulation. In a subsequent study, Sadaf et al. (2023) further examined the relationship between teaching presence and SR and CoR in online case-based instruction. They found that among the components of teaching presence, only *direct instruction* significantly predicted students' perceived regulation. While these findings offer valuable insights into the role of teaching presence in regulated learning, both studies were limited to case-based instructional strategies. Sadaf et al. (2023) emphasized the need for future research to explore specific elements of teaching presence across diverse instructional contexts and disciplines. Such investigations could provide a more comprehensive understanding of how the three presences interact with students' regulation strategies in online learning, thereby strengthening and extending the findings of previous studies.

Purpose of the Study

Recent research highlights the importance of shared metacognition in enhancing learning experiences and outcomes in online environments, demonstrating that it supports critical reflection, planning, and CoR among learners within a group (Garrison, 2022; Garrison & Akyol, 2015; Sadaf et al., 2023). However, researchers suggest a need for more research to help further our understanding of how best to develop the awareness and regulatory strategies to monitor and manage learning processes that enhance student learning outcomes (Garrison, 2022; Sadaf et al., 2022). Therefore, the purpose of this study is to explore the students' perceptions of the role of teaching presence in determining their SR and CoR in online courses. The following questions guided this study:

1. How do students perceive teaching presence (*course design*, *facilitation*, *direct instruction)* in online courses?

2. How do students perceive their SR and CoR in online courses?

3. What is the relationship between students' perceived teaching presence, SR, and CoR in online courses?

Methods

Research Design

Prior research has emphasized the importance of teaching presence in online learning but has offered limited empirical evidence on how specific components interact to influence student metacognitive processes. To address this gap, validated instruments measuring teaching presence developed by Arbaugh et al. (2008) and shared metacognition developed by Garrison and Akyol, (2015) were selected to capture these underexplored dimensions. Regression analyses were used to examine predictive relationships among course design, facilitation, direct instruction, and students' self- and co-regulatory behaviors, thereby extending prior studies that primarily employed correlational or descriptive approaches.

Participants

For this study, convenient sampling was employed to collect data from students enrolled in an online course in a public university in the Southeastern United States. Students were invited to complete both the CoI survey and the Shared Metacognition Questionnaire. After data cleaning, a final sample of 283 students, most of whom provided demographic information. The majority of participants identified as female (72.9%, n = 183) followed by male (25.1%, n = 63), other (1.2%, n = 3), and preferred not to disclose (0.8%, n = 2). Nearly half of the participants (49.5%, n = 137) were between 21 to 25 years old. Most respondents (64.2%, n = 180) had taken more than four online courses, and a large portion (67.5%, n = 187) reported feeling very comfortable with participating in online courses. Table 1 provides detailed demographic information about the study participants.

Table 1

Demographic Information of Participants (n=283)

	N	%		N	%
Gender			Age		
Male	63	25.1	21–25	137	49.5
Female	183	72.9	26–30	39	14.1
Other & prefer not to say	5	2.0	31–35	37	13.4
Student status			36–40	19	6.8
Graduate certificate	25	9.2	More than 40	45	16.2
Master's	248	90.8	Comfort level with online discussions		
Number of online courses taken			Not at all	3	1.1
1	29	10.7	A little	28	10.1
2	39	14.2	Fairly	59	21.3
3	29	10.7	Very	187	67.5
4 or more	180	64.2			

Data Collection

Data were collected through an online survey administered during Spring 2023 using the online survey platform, Qualtrics. Recruitment was conducted through multiple channels to reach a diverse sample of online learners. Email invitations were distributed via professional organizations' list serves, social media platforms, and directly to the professors who teach online courses, requesting that they share the survey link to their students. Additionally, an announcement request was submitted through the university's Institutional Research Study Announcement platform to broaden participation.

Students were asked to reflect on one online course that they were currently taking or had taken most recently while completing the survey. This approach was intended to capture students' perceptions based on their most recent and relevant learning experiences, ensuring that their reflections were accurate and timely. The survey also collected demographic information, including academic program, gender, age, prior experience with online courses, and the level of the degree program.

Students were then asked to respond to two sets of survey questions—Students' teaching presence was measured using the CoI survey developed by Arbaugh et al. (2008), and the Shared Metacognition Questionnaire developed by Garrison and Akyol (2015) was used to measure shared metacognition (SR/CoR). Each item employs a 5-point Likert-type scale, from 1 = Strongly Disagree to 5 = Strongly Agree. Ratings on SR and CoR were represented by 13 items each. For teaching presence, "Design and Organization" was measured with 4 items, "Facilitating Discourse" was measured with 5 items, and "Direct Instruction" was assessed using 4 items. Both surveys have been previously validated, and validation results confirmed their robust reliability and validity (Arbaugh et al., 2008; Garrison et al., 2004; Shea & Bidjerano, 2009; Swan et al., 2008).

The Community of Inquiry (CoI) survey, including teaching presence, is a well-established and psychometrically robust instrument, supported by multiple validation studies across languages and contexts (Arbaugh et al., 2008; Kozan & Richardson, 2014; Yu & Richardson, 2015). More specifically, for instance, Stenbom (2018) conducted a systematic review across 103 empirical studies from 2008 to 2017, and reported that the CoI survey consistently produced valid and reliable results across varied online and blended learning contexts. The Shared Metacognition Questionnaire also demonstrates sound psychometric properties, with clear exploratory and confirmatory factor analysis evidence supporting its structure and use in collaborative learning research (Garrison & Akyol, 2015; Kilis & Yildirim, 2018). In addition, to further confirm the reliability of the included questionnaires, we utilized the current sample to obtain Cronbach's alpha values (Cronbach, 1951). For the SR subscale, α = .93; for the CoR subscale, α = .90. In terms of the three teaching presence subscales, the α values were .89, .92, and .77, respectively for course design, facilitation, and direct instruction. All of the reliability values had demonstrated acceptable to excellent reliability evidence.

Data Analysis

The quantitative design of this study involves several data analytic techniques. First of all, the results of descriptive statistics were presented using means and standard deviations.

Furthermore, a series of multiple linear regressions was performed with the three sub-elements of teaching presence as an independent variable and SR and CoR as dependent variables in the model. This approach was chosen to identify the most parsimonious set of predictors among the three sub-elements of teaching presence for each outcome variable (SR and CoR). Stepwise regression was appropriate given the exploratory nature of this study and the modest number of predictors relative to the sample size. It is worth noting that the study was non-experimental and cross-sectional, no randomization was implemented, and no baseline equivalence testing was conducted. The primary focus of this study was to identify associations between three teaching presence components (course design, facilitation, and direct instruction) and metacognition (SR and CoR), without inferring causal effects.

Results

RQ 1. What are students' perceptions of teaching presence in online courses?

Students' responses to the Teaching Presence scale indicated that they perceived their instructors as most effective in course design (see Table 2), particularly in communicating due dates/time frames (M = 4.38), course goals (M = 4.28), and course topics (M = 4.25). The relatively small standard deviations across all items of teaching presence shows a high level of agreement among students in their perceptions of their instructors' teaching presence. This underscores the significance of well-organized course design and clear communication of due dates, course goals, and topics in improving students' learning experiences in online courses.

Table 2

Students' Perceptions of Teaching Presence in Online Courses (n = 283)

Teaching Presence Items	*M*	*SD*
Course design		
TP1.The instructor clearly communicated important course topics.	4.25	.77
TP2.The instructor clearly communicated important course goals.	4.28	.78
TP3.The instructor provided clear instructions on how to participate in course learning activities.	4.19	.83
TP4.The instructor clearly communicated important due dates/time frames for learning activities.	4.38	.76
Facilitation		
TP5.The instructor was helpful in identifying areas of agreement and disagreement on course topics that helped me to learn.	3.90	.91
TP6.The instructor was helpful in guiding the class towards understanding course topics in a way that helped me clarify my thinking.	4.02	.81
TP7.The instructor helped to keep course participants engaged and participating in productive dialogue.	3.79	1.00
TP8.The instructor helped keep the course participants on task in a way that helped me to learn.	3.87	.96
TP9.The instructor encouraged course participants to explore new concepts in this course.	3.99	.91

TP10.Instructor actions reinforced the development of a sense of community among course participants.	3.66	1.10
Direct Instruction		
TP11.The instructor helped to focus discussions on relevant issues in a way that helped me to learn.	4.02	.81
TP12.The instructor provided feedback that helped me understand my strengths and weaknesses relative to the course's goals and objectives.	3.88	1.00
TP13.The instructor provided feedback in a timely fashion.	4.05	.94

RQ 2. What are students' perceptions of SR and CoR in online courses?

Students tended to perceive higher levels of SR (see Table 3). In general, the mean ratings of the items measuring SR were all above 4.00. The two items receiving the highest identical ratings were "I am aware of my effort" M = 4.46, SD = .67 and "I am aware of my level of motivation" M = 4.46, SD = .63. These results indicate that students are very conscious of their own effort and motivation levels. The relatively low standard deviations suggest a high level of agreement among students regarding their self-awareness in these areas.

At the same time, several SR items had relatively lower mean scores, such as "I question my thoughts" (M = 4.09, SD = 0.95) and "I change my strategy when I need to" (M = 4.19, SD = 0.83). While these ratings remain in the "agree" range, they suggested that students may be somewhat less likely to critically examine their thinking or adapt strategies when necessary. This points to a potential instructional opportunity to integrate reflective prompts and problem-solving strategy training to further develop these aspects of SR.

Table 3

Students' Perceptions of Individual Metacognition (Self-Regulation) in Online Courses (n=283)

Metacognition Items Individual	M	SD
I am aware of my effort	4.46	.63
I am aware of my thinking	4.42	.69
I am aware of my level of motivation	4.46	.67
I question my thoughts	4.09	.95
I make judgments about the difficulty of a problem	4.24	.76
I am aware of my existing knowledge	4.35	.69
I am aware of my level of learning	4.33	.70
I assess my understanding	4.27	.78
I change my strategy when I need to	4.19	.83
I search for new strategies when needed	4.20	.81
I apply strategies	4.25	.69
I assess how I approach the problem	4.22	.79
I assess my strategies	4.17	.79

Regarding the CoR, the variations of ratings among the items were noticeably larger (see Table 4). The highest rating was from item 3 "I consider the feedback of others," M = 4.32, SD =

.72 and item 2 "I listen to the comments of others," (*M* = 4.28, *SD* = .70), indicating that students value and actively engage with feedback from peers. However, the lowest rated CoR terms were "I monitor the learning of others" (M = 3.08) and "I challenge the strategies of others" (M = 3.42). These mean scores indicated that students may feel less comfortable engaging in critical assessment or actively monitoring their peers' learning processes in an online environment. Such tendencies may reflect a lack of confidence in CoR practices. The finding underscored the importance of structured peer-review activities and explicit guidance on constructive critique in online learning environments.

Table 4

Students' Perceptions of Group-Metacognition (Co-Regulation) in Online Courses (n=283)

Metacognition Items Group	M	SD
I pay attention to the ideas of others.	4.25	.70
I listen to the comments of others	4.28	.70
I consider the feedback of others	4.32	.72
I reflect upon the comments of others	4.22	.78
I observe the strategies of others	3.98	.90
I observe how others are doing	4.06	.95
I look for confirmation of my understanding from others	3.97	1.00
I request information from others	3.63	1.06
I respond to the contribution that others make	3.99	.80
I challenge the strategies of others	3.24	1.11
I challenge the perspectives of others	3.42	1.04
I help the learning of others	3.68	.90
I monitor the learning of others	3.08	1.09

Overall, students exhibit a strong sense of SR, indicating a high level of self-awareness about their efforts and motivation in online courses. In contrast, perceptions of CoR learning are more varied. While students generally recognize the importance of considering and listening to peer feedback, the greater variability in these ratings suggests differences in how students engage with and value these learning practices.

RQ 3. What is the relationship between teaching presence, SR, and CoR in online courses?

For this question, the analysis focused on how students' perceptions of their instructors' teaching presence components—*course design*, *facilitation*, and *direct instruction*—is related to SR and CoR. Results of the stepwise multiple linear regression showed that higher perceived effectiveness in *course design* and *facilitation* were significantly associated with stronger SR, explaining approximately 25.9% of its variance (see Table 5). In contrast, *facilitation* was the sole significant predictor of CoR, accounting for 26.6% of its variance. These findings indicate that when students perceive their instructors as actively guiding discussions and fostering engagement (facilitation), they are more likely to engage in collaborative regulatory processes with peers. Similarly, perceptions of clear course organization and facilitation appear to support students' ability to manage their own learning.

The estimated standardized beta coefficient indicated that a one-unit increase in *course design*, on average, led to a .228 unit increase in SR ($t = 3.952$, $p < .001$). In addition, one unit increase in *facilitation* led to a .181 unit increase in SR ($t = 3.723$, $p < .001$). This suggests that together, *course design* and *facilitation* are important determinants of students' ability to SR their learning in online courses. The regression equation was:

SR=2.603+0.228(*course design*) +0.181(*facilitation*)

In terms of the model fit, visual inspection of the histogram (see Figure 2) for the standardized residuals demonstrated an approximately bell-shaped distribution. In addition, the normal curve closely overlaid the histogram bars, suggesting that the residuals were reasonably normally distributed, and was further supported by the symmetry of the distribution around zero. Furthermore, the scatterplot of the standardized residuals versus standardized predicted values displayed a random dispersion of points, without displaying a clear funnel shape or systematic pattern, indicating that the assumption of homoscedasticity was not violated (see Figure 3). Collinearity inspection revealed that all predictor variables had tolerance values well above .10 (values for both predictors were .55) and Variance Inflation Factor (VIF) values well below the threshold of 10 (values for both predictors were 1.817), showcasing that multicollinearity was not a concern in the model. The Durbin-Watson statistic was 1.625, which was between the 1.5 and 2.5 threshold, suggesting the residuals are likely independent.

Figure 2

Histogram of Standardized Residuals for Model 1 (Self-Regulation)

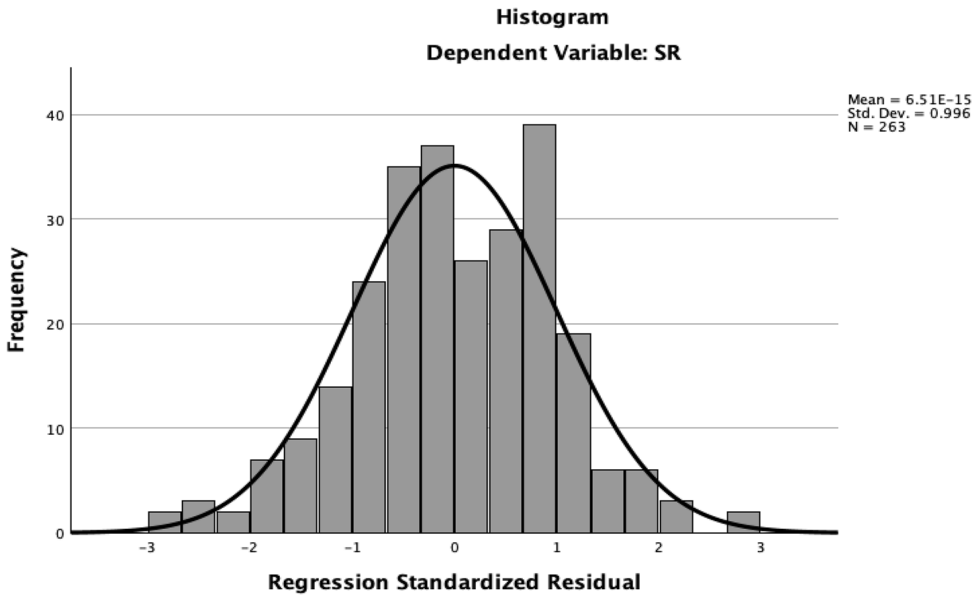


Figure 3

Scatterplot of Standardized Residuals vs. Standardized Predicted Values for Model 1 (Self-Regulation)

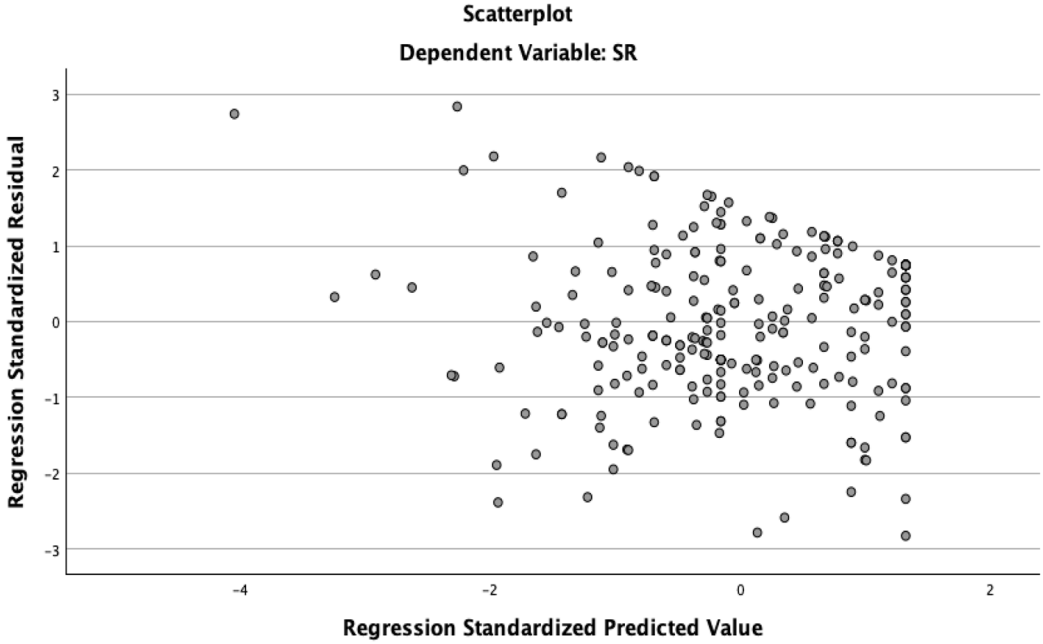


Table 5

Summary of the Multiple Regression Analysis (Model 1)

Analysis of Variance	Dependent Variable: Self-Regulation			
Source	**Sum of Squares**	**DF**	**Mean Square**	**F**
Model	16.932	1	16.932	71.991***
Residual	61.385	282	.235	
Total	78.317	283		
Predictors	**Estimate (standardized)**	**Std. Error**	**t**	**Prob > |t|**
(Intercept)	2.603	.187	13.922	< .001***
Course Design	.228	.058	3.952	< .001***
Facilitation	.181	.049	3.723	< .001***

Note. $* p < .05$, $** p < .01$, $*** p < .001; R = .506, R^2 = .256, adjusted\ R^2 = .250$

In the second multiple linear regression using CoR as the dependent variable, results of CoR identified *facilitation* as the only significant predictor. *Facilitation* explained 26.6% of the variance of CoR, R^2=.266, $F(1, 283) = 96.228$, $p < .001$ (see Table 6). Specifically, one unit increase in *facilitation* led to a .385 unit increase in CoR on average (standardized coefficient beta $\hat{\beta} = .385$, $t = 9.810$, $p < .001$). This shows that students perceive *facilitation* helps them better monitor and manage shared learning dynamics or CoR learning in online courses. Given

its substantial impact, focusing on strategies to improve *facilitation* could lead to better collaborative learning outcomes. The regression equation for Model 2 was:

$$CoR=2.363+0.385(facilitation)$$

For the model fit in this multiple linear regression, the histogram (see Figure 4) for the standardized residuals also demonstrated an approximately bell-shaped distribution. Likewise, the normal curve closely overlaid the histogram bars, confirming that the residuals were reasonably normally distributed, and was further supported by the symmetry of the distribution around zero. Furthermore, the scatterplot of the standardized residuals versus standardized predicted values displayed a random dispersion of points, without displaying a clear funnel shape or systematic pattern, indicating that the assumption of homoscedasticity was not violated (see Figure 5). Collinearity inspection revealed that *facilitation* had tolerance values well above .10 (value was 1.00) and Variance Inflation Factor (VIF) value well below the threshold of 10 (value was 1.00), showcasing that multicollinearity was not a concern in the model. The Durbin-Watson statistic was 2.115, which was between the 1.5 and 2.5 threshold, suggesting the residuals are likely independent.

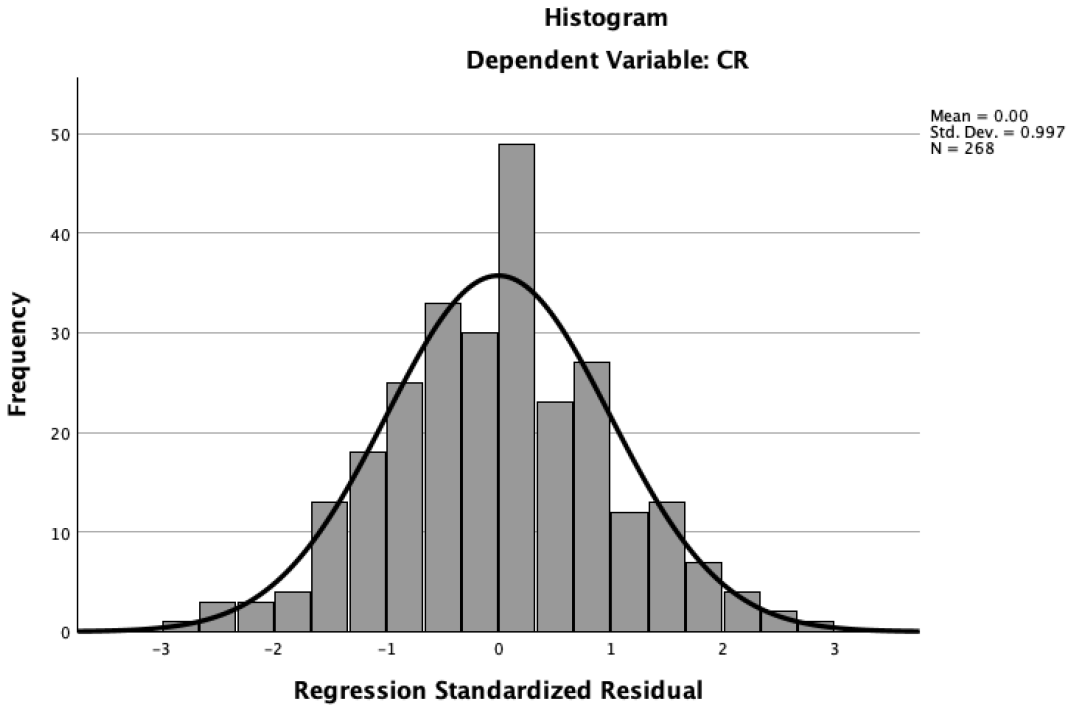


Figure 5

Scatterplot of Standardized Residuals vs. Standardized Predicted Values for Model 2 (Group-Regulation)

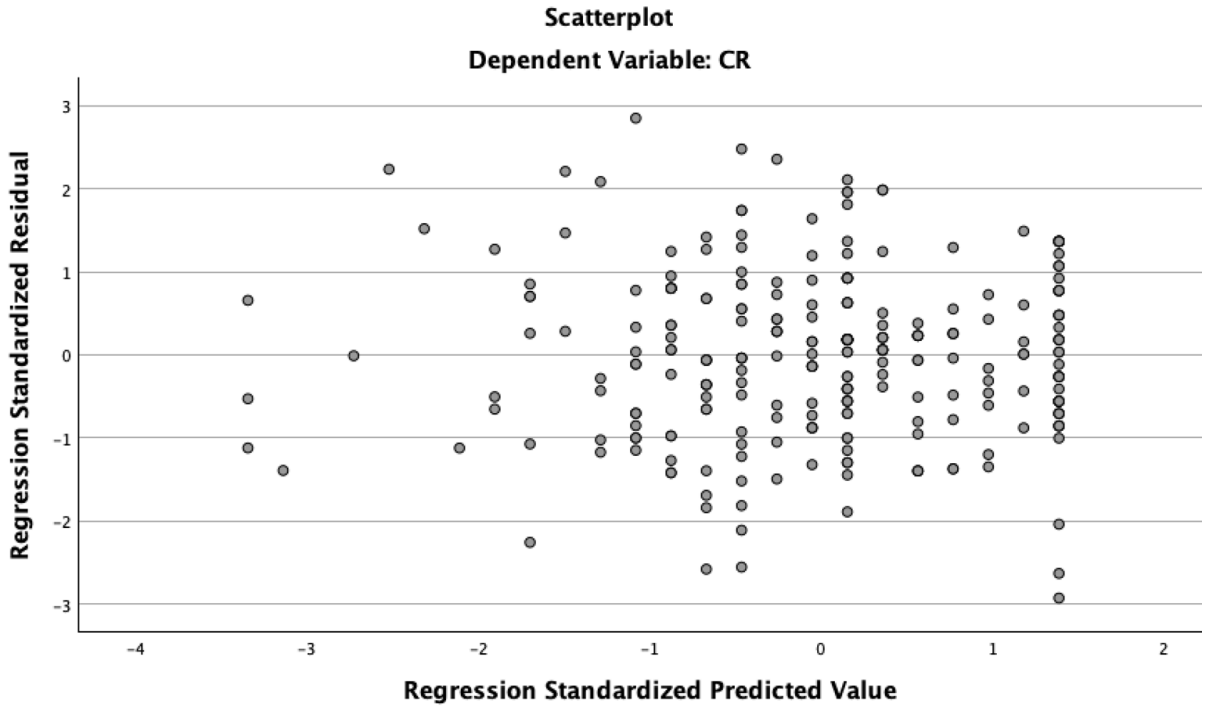


Table 6

Summary of Multiple Regression Analysis (Model 2)

Analysis of Variance	Dependent variable: Group-Regulation			
Source	**Sum of Squares**	**DF**	**Mean Square**	**F**
Model	25.934	1	25.934	96.228***
Residual	71.419	282	.270	
Total	97.353	283		
Predictors	**Estimate (standardized)**	**Std. Error**	**t**	**Prob > |t|**
(Intercept)	2.363	.156	15.183	< .001***
Facilitation	.385	.039	9.810	< .001***

Note. $* p < .05,\ ** p < .01,\ *** p < .001; R = .516, R^2 = .266, adjusted\ R^2 = .264$

Discussion

This study explored students' perceptions of teaching presence and regulation in online courses and examined the relationship between these constructs. The findings offer valuable insights into how students experience and engage with instructional design and collaborative learning processes in online learning environments.

RQ1: Teaching Presence

Students held positive perceptions of teaching presence in their online courses, with particularly strong appreciation for *course design* elements, with the highest ratings given to items related to the clear communication of course goals, topics, and deadlines. This suggests that students place greater value on the organizational and structural aspects of teaching presence, specifically, how clearly their instructors communicate expectations and structure the learning experience in an online course. The emphasis on clarity and structure implies that well-organized course design contributes significantly to students' sense of instructor presence and instructional effectiveness in online learning environments. These results align with Garrison, Anderson, and Archer's (2000) Community of Inquiry (CoI) framework, which emphasizes the foundational role of teaching presence in establishing purposeful structure and direction for meaningful learning. Prior studies have similarly reported that students often perceive design and organization as the most visible components of teaching presence, as these elements shape the overall learning experience and set clear expectations (Sadaf et al., 2023; Shea et al., 2010). A well-structured course provides students with a clear roadmap for learning, reducing cognitive load and promoting engagement (Garrison & Arbaugh, 2007). According to Garrison (2022), fostering metacognitive awareness through intentional *course design* is a foundational step in supporting SR and CoR. Supporting this, Olesova and Sadaf (2023) also found that students in asynchronous online courses identified well-designed readings, discussions, and application-based activities as key elements that enhanced their critical thinking and metacognitive engagement. Similarly, Chen and Chen (2025) highlighted that explicit instructional design, such as clearly stated learning objectives and scaffolded tasks, helped students internalize goals and manage their own learning progress effectively. The small standard deviations across teaching presence items further suggest consistent student perceptions, reinforcing the significance of clear communication and organization. *Course design* acts as a metacognitive map, guiding learners through goal-setting and time management, which are essential for SRL (Hadwin et al., 2011; Jaggars & Xu, 2016). These findings highlight the importance of intentional course design and clear communication as critical strategies for enhancing teaching presence and promoting learner engagement and regulation in online courses.

Self-Regulation and Co-Regulation

Students reported higher levels of SR than CoR, particularly in areas related to self-awareness of effort and motivation. These findings suggest that students perceive their self-regulatory abilities to be stronger than their capabilities for CoR with peers. This pattern aligns with prior research demonstrating that students consistently rate SR more highly than CoR (Cho et al., 2017; Garrison & Akyol, 2015; Sadaf et al., 2022). For instance, Garrison and Akyol (2015) found that learners' perceptions of SR surpassed their perceptions of CoR. Similarly, Cho et al. (2017) highlighted the importance of SRL skills, noting that students with strong self-regulatory abilities tend to show greater engagement in online learning environments. The low

standard deviations further suggest consistent perceptions among students, reinforcing the importance of self-awareness in fostering persistence and effective strategy use (Broadbent & Poon, 2015). However, slightly lower ratings for items related to adaptive strategy use and critical reflection suggest areas for instructional improvement. This points to an instructional opportunity to integrate reflective prompts and problem-solving scaffolds, as recommended by Garrison (2022), to strengthen metacognitive skills and promote strategic learning.

In contrast, perceptions of group metacognition revealed more variability. While students acknowledged listening to and considering peer feedback, they were less likely to report monitoring or challenging peers' strategies. These findings reflect the challenges of fostering CoR in online environments, where social presence may be limited (Järvelä et al., 2018; Koehler et al., 2020; Sadaf et al., 2022). For example, Koehler et al. (2020) found that although students valued instructor feedback in online case-based instruction, some did not fully recognize the significance of their own or their peers' roles in engaging in shared metacognitive processes such as CoR. According to Garrison (2022), learners with strong metacognitive awareness contribute meaningfully to the discourse by exchanging information, evaluating ideas, proposing solutions, and leading the direction of inquiry. To address this gap, intentional *course design* and *facilitation* strategies, such as structured peer review and guided reflection, can enhance students' ability to engage collaboratively and regulate their learning effectively (Garrison & Akyol, 2015).

Relationship Between Teaching Presence, Self-Regulation, and Co-Regulation

Regression analyses revealed that students' perception of instructors' *course design* and *facilitation* significantly predicted SR, jointly explaining 25.9% of the variance. This finding aligns with the Community of Inquiry (CoI) framework, which emphasizes that teaching presence, especially through structured design and active facilitation, fosters metacognitive engagement (Garrison, 2022). These findings emphasize that students who perceived their instructors as effectively organizing the course and actively facilitating learning were more likely to report engaging in self- and co-regulatory behaviors. The positive beta coefficients for *course design* ($\beta = .228$) and *facilitation* ($\beta = .181$) suggest that clear instructional organization and supportive facilitation enhance students' ability to plan, monitor, and adapt their learning strategies, which are the core elements of SR learning (Hadwin et al., 2011; Broadbent & Poon, 2015). These results are consistent with prior research showing that well-structured *course design* promotes learner autonomy and motivation (Johnson et al., 2017; Jaggars & Xu, 2016), while facilitation supports reflective thinking and engagement (Stenbom, 2018). The model's strong statistical assumptions, normality, homoscedasticity, and absence of multicollinearity, further validate these findings.

In the second regression, *facilitation* alone was a strong predictor of CoR, explaining 26.9% of the variance. The strong predictive role of *facilitation* for CoR responds to gaps noted by Garrison (2022) and Koehler et al. (2020), who emphasized the need for strategies that foster collaborative regulation. This study demonstrates that active instructor facilitation through guiding discourse and modeling reflective practices creates conditions for shared metacognition, a dimension often overlooked in prior research. This finding can relate to Olesova and Sadaf's (2023) finding that instructor feedback was the most encouraging facilitation technique for promoting critical thinking in group activities. However, they also found that students often

lacked effective strategies for managing group dynamics, echoing Koehler et al. (2020), who emphasized the need for structured collaboration to support regulation. the instructor plays a critical role in fostering collaborative learning environments where students can CoR their learning processes. As Garrison and Akyol (2015) and Järvelä et al. (2018) argue, CoR thrives in environments where instructors actively guide discourse, encourage peer feedback, and model collaborative inquiry. Similarly, Sadaf et al. (2023) also highlighted the predictive role of *facilitation* in enhancing both SR and CoR, suggesting that instructors who actively facilitate discussions can significantly influence students' regulation. Garrison (2022) noted that learners who are successful in an online environment demonstrate elements of teaching presence by actively supporting both their own and their peers' progression through the inquiry cycle.

Earlier research highlighted the need to understand how teaching presence influences both self-regulation (SR) and co-regulation (CoR) in diverse online contexts (Garrison, 2022; Sadaf et al., 2022). Our results respond to this gap by demonstrating that students' perceptions of *course design* and *facilitation* are significantly associated with SR, and that *facilitation* alone predicts CoR. This study advances scholarship on the Community of Inquiry (CoI) framework by integrating metacognitive constructs of SR and CoR into its applications.

Conclusions and Implications

This study holds significant implications for the design and delivery of online courses. By investigating the relationship between teaching presence and both SR and CoR across diverse instructional contexts, the research provides valuable insights into how different aspects of teaching presence—*course design*, *facilitation*, and *direct instruction*—are associated with students' regulatory processes and learning experiences in online courses.

First, the results reinforce the critical role of *course design* and *facilitation* in supporting students' regulatory behaviors. The finding that students perceived their instructors as most effective in *course design* suggests that clear communication of goals, deadlines, and expectations are positively associated with SR. When course goals, deadlines, and expectations are clearly communicated, students report being better able to plan, monitor, and evaluate their learning. In this regard, instructors should prioritize modular course structures, weekly overviews, and clearly labeled learning outcomes to enhance students' ability to manage their learning. Additionally, learning management systems (LMS) can be leveraged to provide automated reminders and visual progress tracking that correspond with students' regulatory needs. Instructors can provide weekly overviews and checklists to guide students through course expectations. These strategies can reduce cognitive load and foster learner autonomy, which are essential for developing SR skills (Garrison, 2022; Jaggars & Xu, 2016).

Second, *facilitation* was significantly association with both SR and CoR. This highlights the importance of instructor's active role not just in delivering content but in guiding reflection, prompting dialogue, and modeling metacognitive strategies. Instructors can use regulatory prompts in discussion forums (e.g., "What strategy did you use to solve this problem?"), provide reflective feedback and encourage students to articulate their thought processes (e.g., "What strengths do you see in your peer's approach?"). Tools like annotated rubrics and audio feedback can also personalize *facilitation* and support SR. Moreover, *facilitation* strategies such as peer

review, collaborative goal-setting, and reflective prompts may promote CoR in online courses. These practices can help students engage meaningfully with peers and develop shared regulatory strategies (Stenbom, 2018; Järvelä et al., 2018).

Although students reported lower levels of CoR compared to SR, they valued peer feedback and comments. This suggests that peer interaction, when effectively facilitated, can foster CoR learning. The *facilitation* involves the purposeful guidance and coordination of the inquiry process, which includes activities such as setting goals, challenging ideas, exploring alternative explanations, and maintaining forward momentum (Garrison, 2022). Course designers and instructors should incorporate structured peer-review activities with clear rubrics and expectations. For example, they can use guided peer review with prompts like: "What strengths do you see in your peer's approach?" or "What suggestions can you offer to improve their strategy?" Instructors can also design collaborative tasks with clear roles, rotating leadership, and structured reflection. For instance, instructors can incorporate group reflection activities with questions such as: "How did our team approach this task?" or "What could we do differently next time?" Additionally, using peer review protocols, group contracts, or collaborative journals can help students co-monitor and co-evaluate their learning processes. Such scaffolding can help students develop the skills needed to monitor, evaluate, and support one another's learning (Koehler et al., 2020; Garrison & Akyol, 2015).

Overall, the findings of this study show the importance of teaching presence, particularly *course design* and *facilitation*, for students' regulation in online courses. Clear *course design* was positively associated with SR, while *facilitation* showed strong associations with SR and CoR, especially in how students collaborated with peers. Instructors should view teaching presence not only as a means of delivering content or facilitating learning but as a catalyst for metacognitive growth. By intentionally aligning *course design* and *facilitation* with SR and CoR goals, educators can create online environments that support deeper learning, autonomy, and collaboration. Metacognitively aware learners take ownership in guiding, facilitating, and steering the inquiry process in online and blended learning environments (Garrison, 2022).

Limitations and Future Research

This study has some limitations that may lead to future research efforts. First, the study relied on self-reported perceptions, which may be subject to social desirability bias or inaccuracies in metacognitive awareness. Future studies should include triangulated data sources, such as discussion post analyses, learning analytics, or instructor reflections. Second, the study's cross-sectional design limits causal inference. Due to the fact that this study did not include treatment groups or random assignment, and no controls were applied for pre-existing participant differences, the observed associations may be influenced by unmeasured factors. Longitudinal or experimental designs could more effectively capture changes in teaching presence and metacognition over time. Furthermore, the response rate was around 40%. We encourage future studies to take extra steps to increase the response rate. Regarding our sampling method, the use of convenient sampling may not make it possible to replicate the study completely. However, we encourage future studies to test the relationships among variables in different contexts. In doing so, future studies will be able to look into how contextual factors may impact the relationships. We also encourage future studies to look at the causal relations to potentially capture a more

dynamic and longitudinal nature of teaching presence and metacognition. Lastly, CoR needs further qualitative exploration to understand how students negotiate shared regulation and how instructors can better scaffold these processes. Future research might also explore how emerging technologies, including AI-driven facilitation or collaborative tools, impact both teaching presence and shared-metacognition. Investigating these dynamics can further inform the design of inclusive, interactive, and cognitively engaging online learning environments.

Declarations

Conflict of Interest Statement

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Ethics Statement

The authors assert that approval was obtained from an ethics review board (IRB) at the University of North Carolina, Charlotte, USA.

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