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Article abstract

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Integrating Community of Inquiry Framework Principles With Flipped Classroom Pedagogy to Enhance Students' Perceived Presence Sense, Self-Regulated Learning, and Learning Performance in Preservice Teacher Education

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Abstract

The purpose of this study was to assess the effectiveness of integrating community of inquiry (COI) framework principles with flipped classroom pedagogy to enhance students' perceived presence sense, self-regulated learning, and learning performance. A quasi-experimental study was conducted to examine whether integrating COI framework principles with flipped classrooms could enhance college students' perceived presence sense, self-regulated learning, and learning performance. The participants were 64 third-year male college students in an online course at a teacher education university in Iran in 2021. The study employed the COI Survey, the online self-regulated learning questionnaire (OLSQ), and a teacher-made test to measure learning performance. The results indicated significant between-group differences in perceived presence sense, self-regulated learning, and learning performance ($p < 0.001$). Integrating COI framework principles with flipped classroom pedagogy was an effective approach to enhancing perceived presence sense, self-regulated learning, and learning performance among teacher education students.

Keywords: online education, flipped classroom, community of inquiry, self-regulated learning, teacher education

Introduction

As the importance of online education increases, it is essential for future teachers to create and manage effective online learning environments. Therefore, during their preservice course, educators should become familiar with the educational and design-related components of online learning. To teach and learn online, both current and future teachers must complete teacher education programs and take part in professional development programs. However, the dropout rate of students due to the absence of outside support in the virtual classroom is the biggest concern. In asynchronous online learning environments, students must monitor themselves and receive no interactive instruction, resulting in education postponement or dropout (Park & Choi, 2009). As online settings promote self-directed learning, online students are required to be more independent (Serdyukov & Hill, 2013). Therefore one of the required skills for success in such learning environments is self-regulated learning ability (Hu & Driscoll, 2013). Many educators advocate the flipped classroom model, in which class time is dedicated to active learning approaches while advanced technologies are leveraged for external classroom events, where students can access online video lectures prior to class (Bergmann & Sams, 2012). There have been several studies conducted on the effectiveness of the flipped classroom model (Hew & Lo, 2018; Kazanidis et al., 2019). The objective of this study was to explore the potential of integrating principles of the community of inquiry framework (COI) with the flipped classroom model to determine whether this blended pedagogy might maximize the benefits of the flipped classroom to improve learning outcomes among Iranian teacher education students.

Background

Research has shown that self-regulated learning (SRL) is crucial in determining students' successful learning experiences in an online learning environment (Cho & Kim, 2013). In addition, past literature has shown that students may not always successfully regulate their own learning, especially in technology-based learning environments (Lee et al., 2009). As a result, students need intensive instructional support, such as modeling, coaching, and scaffolding for the development of SRL in technology-based learning environments (Azevedo & Hadwin, 2005; Chen et al., 2013). As an initial support method for developing self-regulated learning, teachers can use the flipped classroom to help students develop their self-regulated learning through help-seeking.

Flipped Classroom

Flipped classrooms employ active learning techniques and technology, such as watching online video lectures prior to class (Bergmann & Sams, 2012). In flipped classrooms, learners make use of resources outside of scheduled class time (e.g., detailed notes, recorded lectures, other appropriate tools), and during class, are encouraged to work collaboratively and interactively on activities related to these materials (Butt, 2014).

Advantages of Flipped Classrooms

Studies have demonstrated that flipped classrooms can enhance student' collaboration, creativity, and task orientation (Strayer, 2012), as well as their ability to think critically and develop information literacy (Kong, 2014), and improve learning achievement (Missildine et al., 2013). The use of the flipped classroom model

helps learners become more aware of their need for external help in their studies as well as identify individuals who can assist in resolving their academic problems. If teachers wish to help students develop the self-regulation skill of actively raising questions, in addition to giving the learners the option to choose, they should also consider using the flipped classroom model. This model provides learners with sufficient opportunities to interact with the teachers and their peers, while teachers can also provide learners with guidance and assistance in person. It is suggested that if the resources and environments allow, educational practitioners should assign a sufficient number of TAs to assist with the in-class activities during the flipped classroom instruction.

Drawbacks of Flipped Classrooms

Several studies have identified some drawbacks of flipped classrooms, including taking up teachers' time and making learning more difficult (Mason et al., 2013). To participate fully in flipped classroom activities, students must watch and listen to the online content provided by their teachers. Nevertheless, not all students may benefit equally from video lectures or other multimedia formats (Filiz & Kurt, 2015). Consequently, it is imperative to comprehend that solely assigning students to watch online materials without any accompanying support before participating in a flipped classroom is inadequate. (Horn, 2013). In flipped classrooms, teachers should trust learners to watch lectures at home. Relevant literature (Ash, 2012; Rivera, 2015; Thoms, 2012) has concluded that the flipped method is lacking in terms of interaction and feedback processes during the individual learning phase. Researchers discovered that some students forgot to ask questions if they had to wait until the following week to speak with their teacher about a video they did not understand (Ng, 2018), and Enfield (2013) has argued that students miss the opportunity to quickly correct errors and misunderstandings. Flipped learning models cannot guarantee that students will cooperate or follow instructions; most students would spend hours watching lectures. As well, flipped classrooms may result in numerous learning problems since not everyone possesses the requisite computer skills (Akçayır & Akçayır, 2018).

Community of Inquiry Framework

Enhancing the online learning experience requires creating and maintaining a learning community (Akyol et al., 2009). To achieve this goal, the COI framework created by Garrison et al. (2001) has been extensively applied and explored. Drawbacks to the flipped model, especially lack of interaction and feedback in the pre-class processes, regarded as a major limitation of this approach (Antonio, 2022; Rivera, 2015), may be addressed by the community of inquiry framework. It offers a promising approach for designing pre-class activities in flipped learning models in terms of promoting interaction and feedback among students. COI has been frequently applied for using technology within a constructivist learning design. According to Garrison et al. (2010), students learned collaboratively and as a group in an inquiry community when there was shared cognitive, social, and teaching presences. According to this framework, these fundamental components interact to provide successful learning within a community. Although there have been studies in which the flipped learning approach was designed within the COI framework (Antonio, 2022; Ay & Dağhan, 2023; Günbatar, 2021; Jia et al., 2021), none of these studies integrated COI principles into all stages of the flipped model. Instead, emphasis was placed on designing the pre-class activities. There is a need for further investigation, especially since no research has explored the effect of the flipped model integrated with COI principles on learners' self-regulated learning and learning performance in in preservice teacher education. By integrating the COI as a theoretical framework with flipped classroom

pedagogy, we designed and developed a new online collaborative learning flipped classroom to maximize the benefits of flipped classrooms and address its weaknesess. To reveal the effects of the specially designed flipped classroom model on students' perceived sense of presence, self-regulated learning, and learning performance, the following three research questions were formulated.

Between the two instructional methods (i.e., flipped integrated with COI principles and conventional flipped) were there any differences in

1. perceived sense of teaching/social/cognitive presences?
2. self-regulated learning?
3. learning performance?

Methodology

Participants and Setting

A quasi-experimental quantitative intervention was conducted for this study. The participants were 64 males who were third-year students in an online course offered at a teacher education university in Iran in 2021; they ranged in age from 18 to 22 years (M = 19 ± 0.23). The students were recruited from two intact classes of the same course, taught by the same instructor, and were randomly assigned to the experimental (n = 31) and control (n = 33) group. This two-credit course lasted for 16 weeks; the course content covered various issues in educational planning. In the experimental group, the course was designed and delivered in a flipped classroom model integrated with COI framework principles, while the control group was taught through a conventional flipped model. A learning management system (LMS) was used to present the course and instructional material. It allowed for both synchronous and asynchronous communications between instructor and learners in various forms, including voice, video, and text; it also included online synchronous and asynchronous forums with options for public and private discussions. All necessary notifications for the start time of classes, exams, and learning resources, such as related articles, PowerPoint files, and recorded sessions, were available on this learning platform.

Data Collection Instruments

Data were collected using a survey, questionnaire, and a teacher-made test.

Students' perceptions of community of inquiry principles and its three presence types were measured using COI Survey, originally developed by Arbaugh et al. (2008) and adapted and validated by Taghizade et al. (2018) for an Iranian context. The survey consisted of 34, 5-point, Likert-type items (13 or teaching presence, 12 for social presence, and 9 for cognitive presence). It demonstrated high reliability with a Cronbach alpha value of 0.92 for teaching presence, 0.89 for social presence, 0.93 for cognitive presence, and 0.96 for the whole scale.

The online self-regulated learning questionnaire (OSLQ) developed by Barnard et al. (2009), was adapted and validated by the Taghizade et al. (2020) for an Iranian context to gather data about students' perceptions of self-regulated learning in online learning settings. The questionnaire consisted of 24, 5-point Likert-type items and demonstrated high reliability with a Cronbach alpha value of .94, indicating acceptable internal consistency.

Finally, the teacher-made test included 20 multiple-choice questions with only one correct answer per question, was used to measure students' learning performance. It was taken directly from the textbook used for the two classrooms. Regarding reliability, the KR-20 reliability coefficient was calculated as .84 and .86 for the pre-test and post-test, respectively. The maximum score for the teacher-made test was 20 marks.

Design and Procedure

The instructional procedures for the study are depicted in Table 1. For the conventional flipped classroom, instruction included the following components.

Before the class, students were given pre-class assignments related to educational planning issues and video clips on the LMS to help them acquire knowledge relevant to the issues. These video lectures served to enhance learners' readiness and problem-solving skills by stimulating learners to search for and solve problems related to the content through frequent reviewing of videos (Tawfik & Lilly, 2015).

During the class, students participated in quizzes that assessed their knowledge acquired from pre-class activities and engaged in classroom debates using the group discussion method. During the debates, students were assigned to teams and were requested to discuss the problem, while the instructor supervised and guided learners and encouraged team members to participate in discussions. Through synchronous online discussions, learners were able to share and reflect on their ideas without time and space limitations, and learn from multiple perspectives to create knowledge through interactive dialogues (Lipponen, 2002). Branon and Essex (2001) have argued that prompt interaction and synchronous communication can facilitate feedback, support knowledge sharing, and improve brainstorming and decision making, all of which are considered critical skills for solving problems.

At the end of the class and after online group discussion, the team heads presented the answers orally, allowing other teams to change or complete their answers based on the new insights obtained through feedback from the instructor and other teams. Additionally, the students submitted reports that summarized how their opinions had changed after the debate. Such reports also included student self-assessment of their overall performance in the debate. According to Topping (2009), classroom discussions and oral assessment of peers enhanced learners' reflection on new situations, as well as self-awareness and assessment (Topping, 2009). Furthermore, instructor feedback has been shown to help learners clarify objectives, increase their commitment, and promote learning efforts (Hattie & Timperley, 2007).

In the experimental group, the course was designed and delivered in the form of conventional flipped classroom integrated with COI framework principles in order to facilitate and support each of three COI presences as well as learners' self-regulated learning and learning performance. Five teacher assistants (TAs) supervised the group activities and assisted students with questions. Connections among students, teacher, and TAs outside of class time were maintained through the use of *WhatsApp*.

Cognitive presence was facilitated by:

- creating problems with multiple solutions related to learners' experience
- providing an atmosphere that facilitated dialogue and critical resolution through encouraging learners to discuss and follow certain ideas within a continuous discussion forum
- establishing course regulations that fostered an inclusive space for diverse viewpoints

In addition, learners were encouraged to (a) search for information from various sources; (b)share their suggestions and previous experiences; (c) make connections between information obtained; (d) keep asking questions, create knowledge based on others' ideas, and justify suggested propositions; (e) defend and test new ideas or solutions; and (f) reflect on the results of the newly obtained ideas. Learners were asked to provide support to strengthen their suggested claim when they confronted contradictory evidence. To ensure that students could complete the tasks without missing any important components, a weekly announcement was posted every Sunday morning to remind them of weekly tasks. As well, videos that presented the expected outcome prior to demonstrating the steps for achieving the outcome helped clarify good performance, as opposed to videos that simply outlined procedures.

Social presence was facilitated by encouraging learners to use various paralanguages such as signs, capital letters, emoticons, and avatars to enhance emotional and interpersonal connectedness, as well as to share voice messages, images, and videos. Students were taught (a) social skills and the rules of connectedness prior to the course, (b) ways to determine the consequences of learning in order to enhance learners' stimulation, (c) to acknowledge and appreciate the other's participation to create an open relationship. To show consideration and appreciation for fellow learners, as well as to foster friendly relationships with them, students were encouraged to address each other by their first name. Students used group pronouns (e.g., we) when talking to the group to include all individuals; they were directed to determine the role of learners in each group prior to online discussion (i.e., leader, information collector, discussion organizer, and analyzer). Finally, they were encouraged to share personal anecdotes, work-related events, and incorporate emoticons.

Teaching presence was facilitated through:

- setting goals
- selecting of content and learning activities
- organizing working groups at the beginning of the course
- supervising the learners' purposeful participation and reflection
- recognizing needs, and directing and providing timely information
- distributing teaching duties and roles among learners

- recognizing other's misunderstandings
- synthesizing knowledge from different sources

Discussion was summarized after each session to show and provide links and structural signs to direct and guide learners, and to pave the way for learners to access the resources and related databases. Teaching presence was also facilitated by (a) recreating PowerPoint presentations and lecture notes in the LMS for learners to access, (b) providing guidance on how to use media effectively, (c) revising and commenting on learners' answers, and (d) preventing some learners from controlling discussions while stimulating inactive learners. Students were given sufficient time to do tasks, encouraged to make deadlines to do tasks, and provided with prompt answers to questions and problems. Teaching presence included showing genuine interest in helping students become engaged, giving periodic reminders to listen closely to or review material, and delivering high quality information to students about their learning.

Table 1

Procedures for Experimental and Control Groups

Week	Stage	Experimental group	Control group
1	Before the class	Pre-test, COI pre-survey, and self-regulated learning pre-survey	Pre-test, COI pre-survey, and self-regulated learning pre-survey
2 to 15	During the class	Conventional flipped classroom integrated with COI principles	Watch video lectures Conventional flipped classroom
16	End of the class	Post-test, COI post-survey, and self-regulated learning post-survey	Post-test, COI post-survey and self-regulated learning post survey

Data Analysis

Multivariate analysis of covariance (MANCOVA) was used for between-group comparisons of students' perceptions of the COI presences in each of the experimental and control groups in pre- and post-surveys. Univariate analysis of covariance (ANCOVA) was conducted for between-group comparisons of the students' self-regulated learning and learning performance in the experimental and control groups in pre- and post-surveys and pre- and post-test, respectively.

Results

Students' Perceived Sense of Presences

Descriptive statistics comparing the pre- and post-course surveys of students' perceived sense of presences in the conventional flipped and COI flipped groups indicated that in both types of instruction, the mean score of the post-survey was higher than that of the pre-survey (see Table 2). Also, the mean score of the

COI flipped (experimental group) was much higher than that of the conventional flipped (control group) in all sub-scales of the post-survey.

Table 2

Descriptive Statistics of Pre- and Post-Tests: Students' Perceived Sense of Presences

Variable	Experimental group				Control group			
	Pre-survey		Post-survey		Pre- survey		Post- survey	
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Teaching presence	32.06	6.12	57.39	7.86	33.87	5.92	42.77	4.19
Social presence	26.81	2.96	43.51	1.66	27.96	4.13	38.32	5.14
Cognitive presence	34.24	4.49	55.45	5.70	33.03	4.25	44.38	5.82

The multivariate analysis of covariance revealed an overall effect of the conditions on the students' perceived presence sense sub-scales (Wilks' $\lambda = 0.271$; $F\ (3, 57) = 50.99$; $p < .001$, $\eta 2 = 0.73$) indicating differences between two groups, in at least one of three dependent variables, was significant. Test of between-subject effects (see Table 3) indicated that by controlling for the pre-survey scores, the post-course survey scores of the COI flipped group was higher than that of the conventional group at a significant level ($p < .001$) in all sub-scales.

Table 3

Comparing Results of the ANCOVA for Perceived Sense of Presences

Source	Dependent variable	Type III Sum of squares	*df*	Mean square	*F*	Sig.	Partial Eta squared
Group	Teaching presence	3379.842	1	3379.842	86.389	<.001	.594
	Social presence	353.400	1	353.400	28.357	<.001	.325
	Cognitive presence	1855.164	1	1855.164	55.099	<.001	.483
Error	Teaching presence	2308.286	59	39.123			
	Social presence	735.281	59	12.462			
	Cognitive presence	1986.526	59	33.670			

Students' Self-Regulated Learning

Descriptive statistics comparing the pre-survey and the post-survey in the conventional flipped and COI flipped groups indicated that in both types of instruction, the mean score of the post-survey was higher than

that of the pre-survey (see Table 4). The mean score of the COI flipped group (M = 85.15) was much higher than that of the conventional flipped group (M = 73.45) in post-survey.

Table 4

Descriptive Statistics of the Pre- and Post-Surveys on Self-Regulated Learning

Variable	Experimental group (n = 33)				Control group (n = 33)			
	Pre-survey		Post-survey		Pre-survey		Post-survey	
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Self-regulated learning	64.93	7.34	85.15	12.18	60.83	8.60	73.45	9.52

Table 5 presents the result of ANCOVA. Controlling for the pre-survey, the experimental group (M = 85.15; SD = 12.18) scored significantly higher on self-regulated learning, F (1, 61) = 14.58; $p \leq .05$; partial η2 = .193, compared to control group (M = 73.45; SD = 9.52).

Table 5

Comparing Results of the ANCOVA for Self-Regulated Learning

Source	Type III Sum of squares	*df*	Mean square	*F*	Sig.	Partial Eta squared
Corrected model	2387.147	2	1193.573	10.014	<.001	.247
Intercept	4175.695	1	4175.695	35.033	<.001	.365
Pre-test	199.082	1	199.082	1.670	.201	.027
Group	1738.819	1	1738.819	14.588	<.001	.193
Error	7270.838	61	119.194			
Total	413995.000	64				
Corrected total	9657.984	63				

Students' Learning Performance

Descriptive statistics comparing the pre-test and the post-tests in the conventional flipped and COI flipped groups indicated that in both types of instruction, the mean score of the post-test was higher than that of the pre-test (see Table 6). The mean score of the COI flipped group (M = 17.30) was much higher than that of conventional flipped (M = 15.96) at post-test.

Table 6

Descriptive Statistics of the Pre- and Post-Tests of Learning Performance

Variable	Experimental group (n = 33)				Control group (n = 33)			
	Pre-test		Post-test		Pre-test		Post-test	
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Learning performance	2.90	1.58	17.30	1.79	3.09	1.39	15.96	2.25

Table 7 presents the result of ANCOVA. Controlling for the pre-test, the experimental group (M = 17.30; SD = 1.79) scored significantly higher on learning performance, F (1, 61) = 6.69; $p \leq .05$; partial η2 = .009, compared to control group (M = 15.69; SD = 2.25).

Table 7

Comparing Results of the ANCOVA for Learning Performance

Source	Type III Sum of squares	*df*	Mean square	*F*	Sig.	Partial Eta squared
Corrected Model	28.758	2	14.379	3.431	.039	.101
Intercept	3499.456	1	3499.456	834.899	<.001	.932
Pre-test	.258	1	.258	.061	.805	.001
Group	28.043	1	28.043	6.691	.012	.099
Error	255.680	61	4.191			
Total	18040.000	64				
Corrected Total	284.438	63				

Discussion

Students' Perceived Sense of Presences

According to the results, exposing students to flipped pedagogy enhanced their perceived sense of teaching, social, and cognitive presence in both groups over time. This finding is consistent with previous studies that the flipped classroom created a sense of all three presences in an educational setting (Lee & Kim, 2018). Our findings showed that at post-survey there was a statistically significant difference between learners' perceived sense of teaching, social, and cognitive presence in both the COI flipped and conventional flipped classroom. Prior studies have found similar results regarding cognitive presence (Chen & Chang, 2017; Darabi et al., 2011; Shea et al., 2010). Cognitive presence, which is rooted in critical thinking, provides a hierarchical framework for assessing learners' thinking processes and their abilities to achieve rich levels of learning. Cognitive presence leads the way to conceptualize, assess, and differentiate among varying levels of learners' critical thinking. Learners' cognitive participation to integrate, combine, and assess the discussion ideas is necessary in online discussions to create high-level learning in an interactive online setting (Shea et al., 2010). Attaining this goal calls for strategies that allow learners to create a community

of inquiry through which they can engage in a meaningful critical discussion; this requires cognitive presence.

According to Garrison and Arbaugh (2007), social presence is expected to become more prevalent as the course progresses. In the present study, both groups' social presence increased over time. Social presence reflects social dynamics and the quality of relationships between learners. In the present study, the online learning community, embodied in the authentic interaction and communication via *WhatsApp*, resembled the findings of previous studies in that the learners showed positive response to the flipped instruction (Lucke, 2014; Mortensen & Nicholson, 2014), because most precious instructional time was allocated towards clarification of meaning, problem solving, and interactive collaboration (Bishop & Verleger, 2013; Boucher et al., 2013). The educational videos viewed outside the classroom served as mechanism to "fill the vacuum" that instructors would otherwise have left (Tucker, 2012, p. 83), freeing class time for more advanced learning and engaging students in meaningful, interactive, and collaborative activities for deeper conceptual learning.

Regarding teaching presence, although the interaction between learners is essential in virtual learning environments, it does not guarantee effective online learning, according to Garrison et al. (2010). It is important to define clear parameters for these interactions, focusing on a certain direction, and this calls for elements of teaching presence. Online learning environments require teaching presence to reduce the distance between students and instructors. Teaching presence establishes and ensures a learning community functions consistently. The teacher's level of teaching presence is believed to be an indicator of the quality of online education. Data has shown that teaching presence quality, learning, and learners' satisfaction were strongly correlated in the experimental studies (Caskurlu, 2020). Online learning relies heavily on teaching presence. With a sufficient level of teaching presence, students were generally satisfied, and perceived a relatively high level of cognitive presence (Arbaugh, 2008; Khalid, 2014). Instructors' efforts (e.g., effective course design, the use of scaffolding strategies) have been shown to be crucial for students' perceptions of a COI (e.g., Garrison et al., 2010). The direct connection between instructors and students is relatively smaller than in traditional classroom teaching. Therefore, the interaction between students and instructors becomes more critical and should be more useful for helping students to gradually adapt to self-directed learning.

Students' Self-Regulated Learning

According to our findings, exposing students to flipped instruction promoted self-regulated learning in both groups over the time. Integrating flipped classrooms may improve students' self-regulated learning. The findings in this study were in line with those reported in previous literature including Sun et al.(2017), Silva et al. (2018), and Kustandi et al.(2020) that showed flipped instruction increased students' self-regulated learning.

These results may be attributed to the interaction ("teacher-student" and "student-student" "pre-class" and "in-class" interactions), that plays a key role in enhancing students' self-regulated learning, as well as improving their ability to organize their materials and clearly express themselves in flipped classrooms. Also, students in the flipped classrooms receive more feedback and instructions from their instructors in "pre-class" and "in-class" activities that will impact on learners' process of self-awareness. The significant

result is related to the facilitation of a learning model that motivated learners to proactively request external assistance through the LMS. Through the LMS platform, students used class time for practicing activities, and improving their learning and self-regulation skills (Nguyen & Ikeda, 2015). The results also indicated that the COI flipped classroom students had higher self-regulated learning scores compared to their flipped conventional group counterparts at post-survey. In our experimental group (the COI flipped classroom), online learning was combined with collaborative learning activities prior to and during their class in the LMS and *WhatsApp* and was further supported by guidance from the instructor and TAs. Based on the findings of past studies, peer discussions help transfer learning responsibility, driving self-learning mechanisms and improving learners' ability to self-regulate, thereby enhancing the effectiveness of self-regulation (Grau & Whitebread, 2012; Whitebread et al., 2007). Through teacher-student interactions as well as guidance and feedback provided by the instructor and TAs, learners improved both their self-awareness and the quality of their learning outcomes. This promoted their self-reflection and in turn supported meta-cognitive and monitoring processes (Labuhn et al., 2010; Perry et al., 2002). Also, the difference between experimental group and control group may also be attributed to the mode of learning. In the COI flipped classroom mode, *WhatsApp* provided opportunities for students to collaborate and engage in activities in order to obtain accurate feedback of their performance at a time of their own choosing. Instructors and mentors need to provide high-quality, goal-directed feedback to enable students to adjust their learning in a direction they desire. Moreover, simply providing feedback to students was not sufficient to build their learning presence; that represents elements such as self-efficacy as well as other cognitive, behavioral, and motivational constructs supportive of online learner self-regulation (Shea & Bidjerano, 2010), and they must also start to interpret that feedback through written self-reflection (Labuhn et al., 2010).

Students discussed new topics and concepts prior to class with other students and the teacher via *WhatsApp*. This increased their positive collaboration and may have also helped them engage with others confidently during class, and learn more effectively by working with their peers. This has been evidenced by class activities which also significantly affected students' learning experiences (Bergmann & Sams, 2012). Interactive learning environments such as LMS pique students' curiosity and with their teacher's support, their motivation and learning may also correspondingly increase.

Students' Learning Performance

The findings of the third research question showed that compared to the conventional flipped classroom, the COI flipped model promoted students' learning performance. Consistent with previous studies (Chen & Chang, 2017; Herrera & González, 2017; Pifarré et al., 2014) our results confirmed the positive effect COI framework strategies on students' learning performance. Since COI flipped pedagogy is rooted in constructivism, it is possible that the model from our study improved learning outcomes. According to Chiu et al. (2007), constructivist teaching strategies, with their emphasis on activity-based approaches, provided an enriched learning environment and improved high-level thinking skills, especially critical thinking. Several studies have demonstrated that the COI presences are an effective framework to show the factors that affect students' satisfaction with online learning (Arbaugh, 2008; Estelami, 2012; Khalid, 2014). Students' performance was influenced by the quality, not the quantity, of their interactions with their teachers, according to Pierce and Fox (2012). In the COI flipped instruction employed in the current study,

the instructor served more as a guide than an authority, and supported students to build confidence and learn actively.

Limitations

This study had several limitations. First, the dataset measured COI presences and self-regulated learning based on students' self-reported perceptions, an approach that is prone to response bias. Future studies should gather information from a variety of sources to verify students' self-reported data such as learning management systems, learning records, teacher perceptions, teacher and student interviews, and open-ended questions. Second, the data were gathered from a public university in Iran. To validate this research's generalizability, we recommend replicating it in other settings. Third this study used a convenience rather than a random sample, which reduced generalizability across settings. Finally, the associations between and among the data from the three instruments was not investigated. Instead, we examined each set of data independently of the other two sets.

Conclusion

This study extends the body of information already available about flipped classrooms to maximize their benefits for student learning and motivation. In addition to the flipped classroom model, this study demonstrated that a focus on COI can advance and deepen the learning in flipped classrooms.

Participants were motivated to participate more effectively and apply what they learned to authentic settings by engaging in constructive, collaborative, contextual, and self-directed activities before and during class. Generally, in flipped instruction, the online learning community positively impacts meaningful learning, facilitates positive interaction and collaboration, and significantly improves students' ability to participate in learning activities, such as in-class discussions and group presentations. Based on the results of this study, the integration of COI principles in the flipped classroom seemed to improve the flipped learning experience and pointed to more satisfying outcomes. This study examined a new instructional approach to engage students in a flipped classroom and promote active learning. This approach addressed some of the problems that arise when students are faced with a flipped learning environment, including disorientation, lack of self-regulation, and lack of adequate class preparation.

The COI framework has been widely used by researchers and educators to study the design and implementation of online learning (Garrison & Cleveland-Innes, 2005; Popescu & Badea, 2020; Tan et al., 2020). Results of previous research has consistently shown that the COI presences are an effective framework to reveal factors that affect students' satisfaction with online learning. In this study, we shed light on an area that has not been examined before—the connection between flipped instruction and COI components. We believe that such an approach can guide online teachers to understand effective online learning. Regarding the issue of supporting online learning environment in LMS with a user-friendly environment, the current study employed *WhatsApp*. Use of a user-friendly and easy-to-use social platform could enhance students' perceived levels of social presence, and in turn, facilitate cognitive and teaching presences. Such platforms can be used to support online learning communities to improve interaction, communication, and collaboration, and thereby improve the COI elements.

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