

A Systematic Review of Strategies to Develop Students' Cognitive Presence in Online Courses

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Abstract

This systematic review synthesizes research on strategies used to promote cognitive presence in online courses to identify trends from two decades (2000 to 2020) of scholarship. From initial search of 181 studies, a total of 14 articles published in peer-reviewed journals were reviewed. Results show that all of the studies were carried out in higher education with majority in the United States within the field of Education. Case-based and debate strategies were used the most to promote cognitive presence followed by structured, problem-based, and roles. For the patterns of students' cognitive presence, the majority of student discussions fell into exploration and integration phases with a small percentage within triggering and resolution phases. The study concludes that instructional strategies combined with effective instructional design elements can help learners engage in purposeful collaborative inquiry while progressing through all four phases of cognitive presence to achieve higher level learning outcomes.

Keywords: *Cognitive Presence; instructional strategies; systematic review.*

1. Introduction

Cognitive presence is defined as “the extent to which learners are able to construct and confirm meaning through sustained reflection and discourse” (Garrison et al., 2001, p. 11). It is the core element of the Community of Inquiry (CoI) framework that guides the design and implementation of online learning environments through a social-constructivist approach to learning (Garrison, 2017). CoI assumes that learning occurs at the intersection of the three presences—social presence, teaching presence, and cognitive presence (Garrison et al., 2001). Cognitive presence represents the means to support and maintain a purposeful learning community (Garrison, 2017). It is operationalized through the Practical Inquiry Model (PIM) based on phases of Dewey’s (1933) reflective thinking and a collaborative inquiry process (Garrison et al., 2001). The PIM provides practical ways to evaluate the nature and quality of critical reflection and discourse in a community of inquiry through following (Garrison, 2017) following four phases: (1) Triggering: Identifying a problem or an issue through initiating the inquiry process; (2) Exploration: Searching for relevant information and offering explanation; (3) Integration: Interpreting and constructing possible solution to make decisions; (4) Resolution: Providing or defending potential solutions by means of practical applications.

According to Garrison (2017), “much research is needed to fully appreciate the inquiry process (cognitive presence) that occurs in a shared learning environment.” Given that scholars have explored a variety of strategies to establish cognitive presence and to achieve higher-level learning (Chen et al., 2019; Olesova et al., 2016; Sadaf & Olesova, 2017), a synthesis review of effective strategies in order for instructors to make well informed decisions based on research-based practices is vitally needed (Sadaf, et al., 2021). While there are a few systematic reviews conducted on critical thinking and discussion strategies in general, there are no systematic reviews on the strategies to promote cognitive presence in online courses. Therefore, the purpose of this review is to gain deeper understanding of the current research by reviewing recent articles published between 2000 and 2020. Following questions guided our study:

1. What are the characteristics of the reviewed studies?
2. What are the patterns of students’ cognitive presence phases in the reviewed studies?
3. What instructional strategies are used to promote cognitive presence in online courses?
4. What guidelines exist in the literature with regards to the strategies that promote cognitive presence in online learning?

2. Methods

We used the five-step systematic review process described in the U.S. Department of Education, Institute of Education Sciences, What Works Clearinghouse Procedures and Standards Handbook, Version 4.0 (2017). The five steps included (a) developing the review protocol, (b) identifying relevant literature, (c) screening studies, (d) reviewing articles, and (e) reporting findings.

2.1. Data Sources and Search Strategies

Five databases were searched using the search terms “Cognitive Presence” and “Online learning” for published articles between the years 2000 to 2020 using both the Title, Keyword and Abstract search function. The five databases searched included Academic Search Complete, ERIC Library, Information Science & Technology, PsycINFO and Science Direct. From the initial search, 181 articles resulted. These articles were screened both at the title level, abstract level, and full text level based on the inclusion and exclusion criteria. This resulted in 14 articles which were coded for the systematic review.

2.2. Inclusion and Exclusion Criteria

To be included in this systematic review, each study met the following screening criteria: Focus of the article (Cognitive Presence and Online Learning), publication date (2000 to 2020), publication type (original research from peer reviewed journals), research method (both quantitative and qualitative methods including an identifiable methods section and presentation of results), language (journal article was written in English) and focus on instructional strategies used to promote cognitive presence. A research study was excluded if it did not meet one or more of the criteria to be included.

2.3. Data Coding and Analysis

A review protocol for coding was developed in Microsoft Excel. Items were coded for article description, research design, data collection methods, data analysis methods, research topic focus, and cognitive presence phase included in the review protocol. Two graduate students reviewed and coded each of the articles independently, and then the first author verified the codes. Consensus was reached by resolving any disagreements over discussions. Descriptive statistics were generated to show the patterns and frequency of the variables of interest. Narrative data for research focus and instructional strategy were analyzed using content analysis to identify categorical themes.

3. Results

3.1. Characteristics of Reviewed Studies

The educational setting for all 14 studies was higher education. Most of the studies were conducted in the United States (n=8, 57.1%), two in Canada, and one each in Australia, Netherlands, Spain, and one in both UK and Hongkong. Education was the most common subject (n=7, 50%), followed by two each in Engineering, Health, Human Sciences, and one in multiple subjects. The participants in six of the studies were undergraduate students, six were graduate students, and two included both undergraduate and graduate. Most studies (n=9, 64.3%) used quantitative research design. All 14 studies used online discussion transcripts as the data collection method and content analysis of discussion to analyze data.

3.2. Patterns of Students' Cognitive Presence

Overall, the majority of the studies categorized students' posts as exploration (42%) and integration (31%), with smaller percentages as triggering (15%) and resolution (8%). Six studies coded messages that did not fit any of the four phases of cognitive presence as "other." Most of the studies placed the majority of student posts in the exploration, three studies finding the most messages in the integration phase, and only one study classified the majority of student posts in the triggering phase.

Table 1. Percentage Distribution of Cognitive Presence Phases in Studies

Authors	Main Strategy	Sub-Strategies	T	E	I	R	O
Chen et al., 2019	Peer Facilitation	Guided	11	54	29	1	5
Darabi et al., 2011	Multiple Strategies	Case-based, structured, scaffolding, debate, roles	6	42	41	10	
de Leng et al., 2009	Problem-based	PIM Structured	16	41	27	8	8
Gašević et al., 2015	Roles	Scaffolding	18	39	29	6	8
Gibbs, 2006	Multiple Strategies	Debate, Invited expert	31	33	28	2	6
Kanuka et al., 2007	Multiple Strategies	Debate, Invited expert, problem-based, reflection, WebQuest	11	53	26	10	
Morueta et al., 2016	Multiple Strategies	Case-based, WebQuest, conventional	21	52	26	1	
Oh et al., 2018	Peer & Instructor Facilitation	Case-based, debate	-	-	-	-	
Olesova et al., 2016	Roles	debate, case-based, reflection, problem-based	2	22	74	2	
Oriogun & Cave, 2008	Problem-based	Roles	23	21	17	19	20
Redmond, 2014	Reflection		3	49	15	33	
Richardson & Ice, 2010	Multiple Strategies	Case-based, debate, conventional	-	-	-	-	
Sadaf & Olesova, 2017	Case-Based	PIM Structured	17	51	28	4	
Wang & Chen, 2008	Multiple Strategies	PIM Structured, peer facilitation	22	41	31	0	6
Mean			15	42	31	8	

3.3. Instructional Strategies

The most commonly used strategies to facilitate cognitive presence were case-based strategies (n = 6) and debate (n = 6). These were followed by the PIM structured, problem-based strategies, and roles. Among the less researched instructional strategies were conventional, scaffolding, and inquiry-based represented (see Table 2).

Table 2. Instructional Strategies Used in Cognitive Presence Studies (n=14)

Instructional strategies	#	Studies
Case-based	6	Oh et al. (2018), Sadaf & Olesova (2017), Olesova et al. (2016), Morueta et al. (2016), Darabi et al. (2011), Richardson & Ice (2010)
Debate	6	Oh et al. (2018), Olesova et al. (2016), Darabi et al. (2011), Richardson & Ice (2010), Kanuka et al. (2007), Gibbs (2006)
PIM structured	4	Sadaf & Olesova (2017), Darabi et al. (2011), de Leng et al. (2009), Wang & Chen (2008)
Problem-based	4	Olesova et al. (2016), de Leng et al. (2009), Oriogun & Cave (2008), Kanuka et al. (2007)
Roles	4	Olesova et al. (2016), Gašević et al. (2015), Darabi et al. (2011), Oriogun & Cave (2008)
Peer facilitation	3	Chen et al. (2019), Oh et al. (2018), Wang & Chen (2008)
Reflection	3	Olesova et al. (2016), Redmond (2014), Kanuka et al. (2007)
Conventional	2	Morueta et al. (2016), Richardson & Ice (2010)
Invited expert	2	Kanuka et al. (2007), Gibbs (2007)
Scaffolding	2	Gašević et al. (2015), Darabi et al. (2011)
WebQuest	2	Morueta et al. (2016), Kanuka et al. (2007)

3.4. Guidelines

There is considerable agreement among the articles surveyed on guidelines and best practices for facilitating cognitive presence in online learning (see table 3). Half of the studies recommended that tasks for the strategies should be structured and designed to intentionally guide students through the phases of cognitive presence. Others suggested to provide open-ended strategies, assign roles within discussion, provide additional scaffolding, and design questions that promote progression through the phases of cognitive presence.

Table 3. Guidelines for promoting cognitive presence in online courses

Guidelines and implications	#	Studies
Design tasks to intentionally guide students through the phases of cognitive presence	8	Oh et al. (2018), Sadaf & Olesova (2017), Olesova et al. (2016), Morueta et al. (2016), Redmond (2014), Darabi et al. (2011), Oriogun & Cave (2008), Kanuka et al. (2007)
Provide open-ended strategies conducive for a high level of cognitive presence	3	Morueta et al. (2016), Wang & Chen (2008), Gibbs (2006)
Assign roles with clear guidelines within discussion	3	Olesova et al. (2016), Gašević et al. (2015), Kanuka et al. (2007)
Provide additional scaffolding to help learners achieve the next level	4	Olesova et al. (2016), Darabi et al. (2011), Richardson & Ice (2010), Gašević et al. (2015)
Design initial discussion questions that promote progression through stages of cognitive presence	3	Sadaf & Olesova (2017), Olesova et al. (2016), Richardson & Ice (2010)
Provide pre-structured threads to guide the learner within the model of practical inquiry	3	Sadaf & Olesova (2017), Darabi et al. (2011), Wang & Chen (2008)

4. Discussion and implications

This systematic review revealed several interesting trends regarding the empirical research on the strategies to promote cognitive presence in online learning published between 2000 through 2020. Results revealed that all of the studies were conducted in higher education and almost half of them within the United States. Among four disciplines, a majority of the studies were conducted in Education. This suggests the need to expand research on in other countries and in a variety of disciplines.

In terms of research methodology, quantitative research methods were used the most with discussion transcripts as the main data source and content analysis as the data analysis method. This corresponds previous systematic reviews on cognitive presence in online learning (Sadaf et al., 2021). Less use of mixed-methods and qualitative research methods points to the need to conduct more research using both mixed-methods and qualitative methods that can help accurately understand strategies to promote cognitive presence in different learning modes.

This review shows that the majority of cognitive presence messages fell into exploration and integration phases with a small percentage within triggering and resolution phases. A possible explanation is that the level of cognitive presence achieved is associated with the learning objectives of the strategies. Scholars have concluded that instructional strategies must be employed to allow learners to collaborate in a meaningful critical discourse helping them attain higher-level cognitive presence (Garrison, 2017; Sadaf & Olesova, 2017).

Analysis of the 14 studies revealed that different instructional strategies had different learning outcome in terms to cognitive presence phases. For example, the PIM structured strategy used in Sadaf & Olesova's study reached resolution phase and Darabi et al., (2011) did not. Sadaf & Olesova concluded that students reaching resolution phase was due to that the nature of the task and the wording of the discussion questions. This shows the importance of other elements of design in addition to just using an instructional strategy.

The following six key themes of guidelines emerged from this systematic review that may have implications for developing cognitive presence in online discussions:

1. Task design and structure of the discussion play the most critical role in promoting higher levels of cognitive presence. Structure provided in the early stages of discussion activities can transition to more open activities later on, since the less structured the learning task, the more interaction and cohesion will occur (Morueta et al., 2016).
2. Use open-ended strategies with tasks that are conducive for a high level of cognitive presence are important. For example, case-based and inquiry-based discussion tasks lead to greater cognitive participation (Morueta et al., 2016; Sadaf & Olesova, 2017).
3. Assign roles for students within an online discussion to raise levels of cognitive presence among learners (Gašević et al., 2015; Olesova et al., 2016). Scripted roles in discussions can improve cognitive presence, in particular guiding students through the integration phase with intentional question design (Olesova et al., 2016), and highly structured, planned, confrontational activities (Kanuka et al., 2007).
4. Provide scaffolding to help learners achieve the next level of cognitive presence. The instructor's role as a facilitator of discourse among students includes moderating and shaping the direction of the discourse by modeling appropriate contributions and challenging students' ideas (Garrison & Cleveland-Innes, 2005), monitoring the discussion process and intervening when necessary (Wang & Chen, 2008), and guiding learners in the process of knowledge building (Morueta et al., 2016).
5. Design discussion questions with the specific intent of guiding students through the phases of cognitive presence (Olesova et al., 2016; Sadaf & Olesova, 2017). For example, explicitly asking students to provide a rationale for their solutions or giving them an authentic task such as a case to solve followed by the PIM questions can promote cognitive presence in online discussions (Sadaf & Olesova, 2017).
6. Design pre-structured threads to guide the learner to achieve progression through the phases of cognitive presence (Darabi et al., 2011; Wang & Chen, 2008). The instructor should provide pre-structured threads based on the model of practical inquiry to guide the learner starting with triggering events leading the discussion towards integration and resolution (Darabi et al., 2011; Sadaf & Olesova, 2017).

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