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# Cognitive presence in asynchronous online learning: a comparison of four discussion strategies

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**Abstract** Some scholars argue that students do not achieve higher level learning, or cognitive presence, in online courses. Online discussion has been proposed to bridge this gap between online and face-to-face learning environments. However, the literature indicates that the conventional approach to online discussion – asking probing questions – does not necessarily advance the discussion through the phases of cognitive presence: triggering events, exploration, integration and resolution, which are crucial for deep knowledge construction. Using mixed methods, we examined the contribution of four scenario-based online discussion strategies – structured, scaffolded, debate and role play – to the learners' cognitive presence, the outcome of the discussion. Learners' discussion postings within each strategy were segmented and categorized according to the four phases. The discussion strategies, each using the same authentic scenario, were then compared in terms of the number of segments representing these phases. We found that the structured strategy, while highly associated with triggering events, produced no discussion pertaining to the resolution phase. The scaffolded strategy, on the other hand, showed a strong association with the resolution phase. The debate and role-play strategies were highly associated with exploration and integration phases. We concluded that discussion strategies requiring learners to take a perspective in an authentic scenario facilitate cognitive presence, and thus critical thinking and higher levels of learning. We suggest a heuristic for sequencing a series of discussion forums and recommend areas for further related research.

**Keywords** asynchronous discussions, online learning, cognitive presence, distance learning, discussion strategies, instructional strategies.

Online learning has been characterized as deficient in providing the social interaction needed for the construction and development of knowledge, when compared with face-to-face learning, in complex learning domains (Slagter van Tyron & Bishop 2009). In response to this deficiency, online discussion has been used to bridge the interaction gap between the two learning environments. It has been presented as a substitute for face-to-face social interaction, and therefore has become the subject of investigations focusing on its potential for construction and development of knowledge (e.g. Weinberger & Fischer 2005). According to Collins *et al*. (1991), the development of knowledge is the result of interaction among students, instructor, content and environment or culture as the essential instructional components. The online learning system provides the content, students, and instructor (Moore 1989; Anderson & Garrison 1997; Keegan 2002; Rudestam 2004), but it lacks the rich interaction of these

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three components that occurs in face-to-face classes such as non-verbal expressions and rapid interchanges (Slagter van Tyron & Bishop 2009). Even though online discussions provide substitutes for features of face-to-face instruction by eliciting responses to questions, they often lack the insight-producing spontaneity and continuous feedback of in-depth face-to-face interaction. This interaction, when deep and sustainable, brings about the social construction of knowledge (Gunawardena *et al*. 1997; Sing & Khine 2006) and leads to the higher-level learning (Bloom 1956; Gagné 1985) that has been noted as one of the deficiencies of online discussions (Slagter van Tyron & Bishop 2009). In their revision of Bloom's taxonomy of learning in the cognitive domain, Anderson and Krathwohl (2001) identified the higher levels of learning as analysing, evaluating, and creating, and the lower levels as remembering, understanding, and applying.

In order to generate higher-level learning in an online interactive environment, online discussions should demand cognitive collaboration of learners, resulting in integration, synthesis and evaluation of discussion ideas. To accomplish this goal, strategies must be employed to allow learners to construct a *community of inquiry* through which they collaborate in a meaningful critical discourse requiring *cognitive presence* (Garrison *et al*. 2000).

## The community of inquiry and cognitive presence

The community of inquiry model, used as a practical approach for judging the quality of critical discourse in distance learning, requires the presence of instructors and learners in a socially interactive context using critical thinking to achieve higher-level learning as the goal of online education (Garrison & Archer 2007). In their description of this model, Garrison *et al*. (2001) identified cognitive presence as one of the key elements of effective online learning. Cognitive presence is 'the extent to which learners are able to construct and confirm meaning through sustained reflection and discourse in a critical community of inquiry' (Garrison *et al*., 2001, p. 9). In this context, cognitive presence is operationalized into four phases of critical inquiry: triggering event, exploration, integration and resolution. The concept of critical inquiry, stemming from Dewey's (1933) practical inquiry model, has also been used to assess the process of learning (Garrison *et al*. 2000) in a variety of settings (Akyol *et al*. 2009).

According to Garrison *et al*. (2000), the *triggering* event occurs in the learners' shared environment in which they gain perceptions of the content and *explore* it individually and inquire about the application of the content. Through this process of inquiry, learners test different hypotheses conceptually and reflect on the outcomes to accomplish an *integration* of the content. It is through their discourse in the *resolution* phase that learners practically try out their ideas or conceptions. In order to start *understanding* the content, learners restate and clarify information during the triggering event phase. In the exploration phase, learners *apply* their ideas to different settings and *analyse* different parts of the content. They judge and *evaluate* the outcomes of the analysis in relation to some criteria in the integration phase. Based on this evaluation, learners *create* solutions during the resolution phase.

To further analyse these phases, Park (2009) developed a list of subcategories for each phase. Clarifying and restating information were listed as subcategories for the triggering event phase. For exploration, Park listed six subcategories as indicators of the process, including sharing personal experiences, opinions and resources. The integration phase included five subcategories such as suggesting new solutions and drawing hypotheses from the information gathered. Three subcategories were listed for the resolution phase that included, for example, applying, testing and defending the hypotheses generated. Park used these subcategories to guide a content analysis of asynchronous online discussions. (See Table 1 for a complete list of the subcategories.)

The conventional method of online discussion in which students respond to isolated questions and usually state their agreement or disagreement with each others' responses often does not facilitate learners' cognitive presence in all four phases. As Toledo (2006) points out, the nature of such questions is integral to generating students' critical thinking; 'if we want our students engaged in the critical thinking process we must motivate them with well-written questions that guide them into asking more questions' (p. 150). This method, even though triggering learners' interest and engagement in the discussion, usually does not extend the discussion beyond the exploration phase (Meyer 2003; Park 2009). It requires learners to express their knowledge, opinions, or beliefs but falls short of

Table 1. Phases of cognitive presence rating rubric from Park (2009).

| Phase of cognitive presence | Subcategories |
|---|---|
| 1. Triggering event | Clarification<br>Restating |
| 2. Exploration | Agreement: agreement without substantiation<br>Information sharing: stating a fact, policy or rule; citing a source<br>Divergence: disagreement<br>Leap to Conclusion: no relationship to previous discussion, not logical<br>Personal Narration: story, relating an incident, describing practices at their job<br>Opinion: belief or judgement, personal view, attitude based on grounds insufficient to conclude factual |
| 3. Integration | Building on: augmenting a point made by self or by another earlier<br>Creating Solution: novel conclusion<br>Justified hypothesis: a tentative assumption made in order to draw out and test its logical consequence to prove or show to be just, right or reasonable; coming to a conclusion predicted by ongoing discussion but supporting with relevant reason<br>Supported divergence: disagreement with reason stated<br>Supported agreement: agreement with reason stated |
| 4. Resolution | Wrap-up: concluding; summarizing<br>Thought experiment: questioning 'what if?' or 'what do you think about?'<br>Apply, test and defend: any of the three but not retrospective narrative; must be an application of new thought initiated by the discussion present. |

facilitating integration of their ideas with others' or resolution of their differences. Lack of discussion structure and a need for better facilitation have been cited as reasons for these shortcomings (Picciano 2002; Meyer 2003; Pawan *et al*. 2003; Garrison & Cleveland-Innes 2005; Shea *et al*. 2005; Swan & Shih 2005; Vaughan & Garrison 2005; Celentin 2007).

Despite these deficiencies, asynchronous online discussions can aid in the social construction of knowledge as posited by the situated cognition literature (e.g. Brown *et al*. 1989; Lave 1997; Wilson & Meyers 2000). When the online learning environment provides learners with a specific discussion context and a goal, the construction of knowledge can occur. With shared understanding of this context, online learners can work towards their goal through interaction. The discussion context, when properly designed, has been found to be a significant facilitator of collaborative discourse that leads to higher-level learning (Han & Hill 2007). However, the scenarios should be contextualized in authentic situations and anchored in the real-world tasks (Hung & Chen 2001; Naidu *et al*. 2007; Rovai 2007).

In response to these recommendations, researchers have sought better online discussion strategies such as pre-structured threads (Gilbert & Dabbagh 2005; Brooks & Jeong 2006), scaffolding (Azevedo & Hadwin 2005; Oh & Jonassen 2007), role assignments (Jonassen *et al*. 1995; De Wever *et al*. 2010) and debate (Johnson & Johnson 1992; Baker 1999). Each of these strategies has its own strengths and limitations with regard to enhancing the quality of the discussion.

Brooks and Jeong (2006) found that pre-structured threads, in which the instructor provides a series of detailed prompts, increased the frequency of discussion posts that initiated meaningful discourse. These prompts are sometimes called 'online scaffolds' because they simulate the scaffolding of an instructor by anticipating difficulties learners might have in generating questions for their peers to advance the discussion (Choi *et al*. 2005). One of the potential limitations of this strategy is that in developing the prompts, the instructor might not correctly anticipate the difficulties learners will have in advancing the discussion. Naturally, the instructor's ability to correctly anticipate difficulties and develop useful prompts would improve with repeated iterations of the same course, but there is always a possibility that a learner will have a novel, unanticipated difficulty.

Scaffolding, described as having a teacher or a mentor ask probing questions throughout the discussion in response to learners' postings, was found to result in higher-level reflection (Whipp 2003). In this strategy, the instructor tends to be more an active facilitator (Goodyear *et al*. 2001) than a provider of prompts as in the strategy using pre-structured threads. As such, mentors can adapt to the way the discourse unfolds and respond to specific directions of the discussion by realigning it to the intended direction if it goes astray. The limitation is that the instructor or the mentor must spend a great deal of time following the discussion and providing prompts, and the approach might be impractical for large classes entailing numerous simultaneous group discussions.

Discussions with role assignments in authentic scenarios have been found to result in construction of higher levels of knowledge (De Wever *et al*. 2010). The roles typically involve specific roles in the online discussion process but can also involve playing roles in a simulation of practitioners solving authentic problems. McLaughlan (2007) found that role-play simulations of a civic engineering project were effective in fostering understanding of the multiple perspectives on complex problems of sustainability when undergraduate engineering students discussed their roles in the simulations. One value of the authentic role-play discussion strategy is that it requires learners to embrace the perspective of the role they play and to consider the multiple perspectives of other roles while engaging in dialogue. A possible limitation of this strategy is that learners must have sufficient knowledge of the values and priorities inherent in the role to be able to effectively play the part. Without such knowledge, learners could face the *metacognitive knowledge dilemma* (Land 2000), in which they are trying to make 'connections between representations and meanings while they are simultaneously learning these representations and meanings' (p. 68). This dilemma would arise if learners have insufficient domain knowledge required for engaging in the metacognitive skill of continuously self-evaluating their performance at playing their role.

The debate strategy, grounded in dialogic theory, has been associated with deeper understanding than the conventional method because of the conflicting nature of the discourse (Johnson & Johnson 1979, 2000; Baker 1999). In ill-structured problems, for example, argumentation allows learners to construct and justify their own solutions when a singular solution does not exist (Jonassen 1997). Arguments, as an inherent part of debate, alleviate misconceptions through learners' attempts to justify their assumptions and solutions (Jonassen 1997), confronting inconsistencies in reasoning, and ideally resolving differences between perspectives. However, when learners are randomly assigned positions in a debate, some learners might be assigned to a position that matches their own perspective. Consequently, they might simply argue for their viewpoint, never critically examining their own perspective or considering those of others, thus negating the potential opportunities afforded by the debate strategy.

Based on these findings, we designed four strategies, similar to the ones mentioned above, situated in an authentic discussion context for an online course to examine the extent to which they facilitate the four phases of cognitive presence. The purpose of the experiment was to determine whether the discussion strategies exceed the limitations of the conventional approach to online discussion. We were also interested in finding which one of the strategies led to learners' superior cognitive presence during online discussion. In other words, we wanted to find out which strategy leads to the highest levels of cognitive presence, integration and resolution during discussion. The implications of the results for designing discussion strategies and conducting future research are included in the discussion section.

## Method

This study utilized mixed methods including content analysis, a form of analysis that transforms qualitative data into quantitative data through coding and ratings by multiple raters. The ratings were then analysed using descriptive statistics and a goodness-of-fit test to compare the outcomes of the four strategies.

### Participants

Out of 99 students enrolled in an online section of an undergraduate course on stress and resilience in children and families, 73 participated in this study. The course was offered over a 15-week long semester and delivered via the university's online course management system, Blackboard. Students were all juniors and seniors in a large North American university.

### Study design

At the beginning of the course, the instructor had divided the students into four groups and assigned a graduate student to each group, whom he labelled 'mentor.' Mentors were expected to manage the sessions and monitor learners' progress to assist the instructor with grading and managing the course. The investigators used this structure to administer the discussion task designed for this study. The learners performed the discussion task regarding risk factors and intervention programmes for children and families in a 1-week period. To prevent the sampling bias presented by the original group assignments, the students in each mentor group were randomly assigned to one of the four discussion strategies developed for performing this discussion task.

*Discussion task*

The task performed in this scenario was a decision-making problem that Jonassen (2010) refers to as a rational choice model, in which group members must compare the advantages and disadvantages of alternative solutions. This scenario was developed based on a primary competency acquired in this course. Students were provided with specific instructions that corresponded with their assigned discussion strategy. The discussion task presented the students with a scenario simulating a school district committee required to choose an appropriate intervention for a social problem considering its associated risk factors. The students were additionally presented with the information about the target population, including statistics on existing risk factors and social problems (see Supplementary Materials). Learners applied concepts, such as population risk level, relative risk factor, intervention level, and target system – all part of the readings and lectures for that week – based on which they recommended an intervention combating the identified social problem. Participants discussed the problem within the 1-week time limit and were encouraged to come to a consensus-based conclusion, given one of the following four discussion strategies.

*Structured.* In the structured approach, specific questions under different threads were supported by detailed discussion prompts. We used this strategy to design discussion questions advancing students through the phases of cognitive presence in the context of the discussion task. Questions involved specific content that the learners were expected to apply, as presented in the following example: 'What problem or risk factor will your intervention focus on? In which system does this problem or risk factor take place?' To encourage them to move toward resolution, the last prompt they received was, 'Which intervention idea do you agree with? Which has the best rationale given the resources given to your group? Why? Make sure to ask your fellow group members questions.'

*Scaffolded.* For this strategy we chose student mentors to scaffold the discussion as opposed to the instructor because students generally prefer peer discussion leaders (Rourke *et al*. 2001). Using a PowerPoint presentation, the investigators conducted an orientation session for the mentors, who were all graduate students, to introduce them to the purpose and design of the study as well as its required logistics. As part of this orientation, mentors were presented with a description of scaffolding and its significance in an instructional context. They were then given the scenario of the discussion task and practice discussion threads. They were asked to raise questions focusing on advancing the discussion towards a consensus among the group members on recommending an intervention. The mentors were then instructed to monitor the actual discussion and raise similar questions after each posting deadline. This was the only strategy in which the mentors actually participated in the discussion.

*Forced debate.* To implement this strategy, the participants assigned to the debate strategy were randomly assigned one of two positions, each arguing for or against the appropriateness of a given intervention. Learners in the proponent role would construct arguments in favour of the proposed solution. Through their debate, learners arguing against the given solution examined, compared, and contrasted alternative solutions while exposing their counterparts to the advantages and disadvantages for their position.

*Role play.* In this strategy, students had to assume the role of a professional in their field, such as teacher, adviser, counsellor, and policymaker. These roles were suggested, but the students were able to choose any other role as well. The participants were then instructed to perform the discussion task from the perspective of their particular roles, examining the options from the perspectives of the roles other learners had taken, as well as their own perspective.

Table 2. Segmentation of an example post from a student in the role-play group.

| Segments | Phase | Subcategory rating |
|---|---|---|
| As a high school guidance counsellor, I witness the troubles students have with reading. | Exploration | Personal Narration: story, relating an incident, describing practices at their job |
| There is a 50% risk factor that students who are reading below their grade level will drop out of school . . . | Triggering event | Restating the information from the scenario |
| I believe we should use the 100 K to come up with a programme to guide these children, and better their reading skills . . . | Exploration | Opinion: belief or judgement, personal view attitude based on grounds insufficient to conclude factual |

### Procedure

The students were notified about the project and their informed consent was obtained. They were already divided into four instructional groups by the instructor. This class structure limited our ability to randomly assign the whole class into the four strategies. Given this constraint, we assigned students in each instructional group randomly to one of the four strategies. This resulted in 16 small and more manageable discussion groups (4 Mentor Groups × 4 Strategies) with approximately six students in each group. These small groups were then combined under each strategy for the purpose of the analysis. Participation in the discussions was optional; students were only required to participate in 11 out of 12 discussions, and not all students in the class chose to participate in this particular discussion. The students were given 1 week to complete the discussion assignment with three individual deadlines for postings to assure that they would post at least three times. The participants were asked to collaborate and come to a consensus resulting in a resolution to the stated problem in the scenario they discussed.

### Data analysis

Data collected from the content analysis via the learning management system were transferred to a spreadsheet at the conclusion of the discussion week. Because of technical problems with the learning management system, one of the four strategy subgroups within an instructional group could not participate in the discussion. The entire instructional group was excluded from the analysis and used for rater orientation. Two graduate students and a faculty member rated the students' discussion postings. The postings were segmented by into *illocutionary statements*, in which 'a change in purpose sets the parameters for the unit' (Rourke *et al*. 2001, p. 18). Each rater received the segmented postings in a spreadsheet file and categorized each segment independently into one of Park's (2009) 16 subcategories of cognitive presence (see Table 1). In an orientation session, the raters rated one set of postings and discussed their perceptions of the subcategories, compared notes, and came to a consensus on the definitions of each subcategory for their independent rating of the remainder of the postings. This exercise resulted in a total of 281 segments, each of which was coded as 1 of the 16 subcategories of cognitive presence. The segments were then recoded as indicating one of the four phases of cognitive presence to which the subcategories belonged. Table 2 displays an example of how one student's post was segmented and then coded by phase and subcategory. We then examined the frequency of segments as indicators of the cognitive presence phases across strategies.

## Results

The inter-rater reliability among the three raters who coded the segments into indicators representing the phases of cognitive presence was calculated at 0.838 using the intra-class correlation. The descriptive statistics on the learners and their postings for each strategy are presented in Table 3. As Table 3 displays, the debate and role-play groups included more learners than the scaffolded and structured groups. The highest number of segments per learner was posted by the scaffolded group with a mean of 5.62 segments. The role-play group wrote the longest segments, on average, with 333 words per learner.

Our analysis was focused on the associations of the four discussion strategies with the phases of cognitive presence. A chi-square test, $\chi 2(d.f. = 15,$

Table 3. Descriptive statistics ($N = 73$).

| Strategy | Number of learners | Number of segments | Mean segments per learner | Mean words per learner |
|---|---|---|---|---|
| Structured | 14 | 41 | 2.93 | 184 |
| Scaffolded | 16 | 73 | 5.62 | 302 |
| Debate | 22 | 92 | 4.18 | 279 |
| Role play | 21 | 75 | 3.57 | 333 |

$N = 73) = 21.12$, $P = 0.012$, showed overall significant associations among the strategies and the phases. Our examination of the differences among strategies by phase revealed the number of segments within each phase as reported in Table 4. For the triggering phase, significant differences among strategies were found [$\chi 2(d.f. = 3, N = 73) = 7.83, P = 0.050$], with the structured strategy accounting for the largest number of segments (6) and the debate strategy yielding the least segments (2). For exploration, the debate strategy resulted in the highest number of segments (43) with statistically significant differences among strategies [$\chi 2(d.f. = 3, N = 73) = 20.72, P < 0.001$]. Under the integration phase, the debate strategy resulted in the largest number of segments (38), and role-play resulted in the second largest (37) with significant differences among all strategies [$\chi 2(d.f. = 3, N = 73) = 28.57, P < 0.001$]. Among the three strategies that produced segments in the resolution phase, there were no significant differences [$\chi 2(d.f. = 2, N = 73) = 1.75, P = 0.417$]. However, the structured strategy had no segments, indicating that the resolution phase and the scaffolded strategy resulted in the most segments (14).

Our further examination focused on identifying the most relevant strategies by comparing the percentages of segments indicating the phases of cognitive presence across each strategy (see Table 4). In the structured strategy, the highest percentage of indicators was observed for the exploration phase (48.8%). The second highest percentage of segments this strategy produced occurred in the integration phase (36.6%). As in the structured strategy, the scaffolded strategy produced the highest percentage of segments representative of the exploration phase (38.4%), and the second highest in the integration phase (35.6%). Within the debate strategy the highest percentage of segments represented the exploration phase (46.7%), and the second highest indicated the integration phase (41.3%). In the role-play strategy, almost half of the segments represented the integration phase (49.3%). The structured and scaffolded strategies showed a rather strong occurrence of segments in the triggering phase (14.6% and 29.4%, respectively) compared with the other strategies. The highest percentage of segments (19.2%) relevant to the resolution phase occurred in the scaffolded strategy in which the mentor interaction promoted collaboration to resolve their different perspectives.

## Discussion

The popular practice of students' participation in online discussions limits them to answering questions posed by the instructor in discussion threads. Research has shown that simply posing questions for learners to answer does

Table 4. Learner generated segments within each strategy across cognitive presence phases.

| Strategy | Triggering | | Exploration | | Integration | | Resolution | | Total | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Count | % | Count | % | Count | % | Count | % | Count | % |
| Structured | 6 | 14.6 | 20 | 48.8 | 15 | 36.6 | 0 | 0.0 | 41 | 100 |
| Scaffolded | 5 | 29.4 | 28 | 38.4 | 26 | 35.6 | 14 | 19.2 | 73 | 100 |
| Debate | 2 | 2.2 | 43 | 46.7 | 38 | 41.3 | 9 | 9.8 | 92 | 100 |
| Role play | 4 | 5.3 | 28 | 37.3 | 37 | 49.3 | 6 | 8.0 | 75 | 100 |
| Total | 17 | 6.05 | 119 | 42.35 | 116 | 41.28 | 29 | 10.32 | 281 | 100 |

Note: % = % within strategy.

not elicit the same higher-level learning that in-depth face-to-face interaction produces (Gunawardena *et al*. 1997; Sing & Khine 2006). Without substantive interaction among online learners, focusing on integrating information and synthesizing ideas, development of higher level knowledge is limited (Slagter van Tyron & Bishop 2009). The higher-level integration and resolution of new information does not often result from the online discussions as they are commonly practised (e.g. Weinberger & Fischer 2005). They usually occur as the result of collaboration of instructor, student, content and environment Collins *et al*. (1991). In order to create such an instructional experience, online learning should facilitate learners' cognitive presence. Strategies that cultivate learners' cognitive presence should be developed, examined and recommended if found effective. This study sought to examine strategies particularly developed for this purpose. Our examination of the effectiveness of these strategies in generating discussion representing the phases of cognitive presence resulted in their distinct but different associations with the phases of cognitive presence.

The strategies used in this study differed from the conventional method of online discussion in terms of complexity. Their complexity stemmed from the fact that each strategy had more interactive elements, a task-oriented approach to discussion and authentic scenarios presenting a situated learning environment. This complexity presented a somewhat hierarchical order among the strategies.

The structured strategy, for instance, was made more complex than the conventional method by presenting a series of questions under different threads supported by discussion prompts that were intended to take the learners through the phases of cognitive presence. Additionally, the strategy introduced the element of group interaction that often does not exist in the conventional method. Similar to previous findings (Meyer 2003; Park 2009), we found that this strategy did not result in discussion that progressed to the resolution phase. Even though the participants answered the resolution question, they did not reach this level of cognitive presence because of what seemed to be inherent to this strategy – the lack of deep and sustained interaction as Sing and Khine (2006) argued. As an example, when one student posted 'I still am going to stick with my first argument that primary prevention is the best possible intervention idea. It is important to stop this from happening as soon as possible and it should be one of our main concerns,' no one replied to or asked questions of the student.

The structured strategy was significantly associated with the triggering phase of cognitive presence. Learners using this strategy generated a high percentage of triggering segments, which showed that they were attempting to clarify the task and restate the scenario by responding to the prompts. These learners using the structured strategy produced no segments indicating the resolution phase of cognitive presence and the lowest number of segments associated with the integration phase. We speculate that the weak association of this strategy with the integration phase and no representation in the resolution phase were due to the strategy's simplicity. Learners were not deliberately engaged in the multidimensional interaction experienced by learners in the more complex strategies. Even though the prompts of the structured strategy were intended to direct the learners to think deeply about their responses, the prompts apparently could not substitute for the engaging elements required to advance to the resolution phase as the other strategies did. However, within the strategy, the majority of the segments were associated with the exploration and integration phases. The reasons for the structured strategy not being strongly associated with the higher phases of cognitive presence, we speculate, include learners' uncritical responses to questions and their not being required to state a position or argue for one – the elements of the more complex strategies. They had a limited task requirement and an inadequate mechanism to lead the discussion towards a meaningful resolution of the ideas.

The scaffolded strategy, on the other hand, made the discussion task more complex by introducing the mentor element, which was designed to lead the discussion towards the latter phases of cognitive presence. The mentors' orientation prepared them for their interaction with learners as well as encouraging learners' interaction with one another through these kinds of questions. The mentors raised questions to advance the discussion towards a consensus among discussants. The strategy required the learners to interact with the mentors while discussing inquiring prompts similar to those of the structured strategy.

The analysis indicated that the scaffolded strategy was strongly associated with all of the phases of cognitive presence. However, the learners using this strategy generated a highest percentage of segments associated with the resolution phase compared with the other strategies. The reach of this strategy to the higher phases of cognitive presence, we contend, was due to the introduction of the scaffolding element in the form of a mentor who was responsible for monitoring learners' interactions, inspecting their postings and guiding the discussion towards a consensus. This high level of involvement on the part of the mentor influenced the learners' progress through the phases of cognitive presence concluding with the resolution phase. We believe mentors' prompts such as 'What do you think the afterschool program should include and why? How will this be effective?' guided the learners to construct their causal reasoning by thinking about the what, why, and how elements of a resolution to the stated problems (Jonassen & Ionas 2008). It is noteworthy to find a difference in learners' generation of thoughtful statements because of the addition of mentors as an instructional feature. It illustrates the importance of providing learners with the involvement of a designated authority in a pedagogical role who can guide the learners' interaction.

The debate strategy added a more complex instructional feature by requiring the learners to argue either for or against an intervention. This task was more complex because of the argument dimension in which learners had to interact, take a position, and own it so that they explore and integrate the content in preparing their argument. This seems to be the reason for learners generating the highest number of segments in the exploration and integration phases. Compared with other strategies, the debate strategy had the second highest count of resolution statements. Given these frequencies, we argue that the strategies elicited fundamental cognitive processes on the part of learners. Throughout the debate they examined, compared and contrasted alternative solutions through which they were exposed to the complexity of critical thinking about solving the problem. The learners' mental effort to generate discussion postings that justified their position on the debate issue and convinced their counterparts of this justification led to integration of ideas that elevated their thinking to the higher levels of cognitive presence.

Finally, in the role-play strategy, learners assumed a meaningful role and argued for a position representing the role while considering others' perspectives on how to solve the problem. This strategy also generated a high number of posting segments across the cognitive presence phases, reaching the highest at the integration phase. We believe this is due to the strategy demanding learners' higher-level cognitive processes through assuming a role, assessing the implications of their decisions in that role and finally justifying their decisions. A strong feature of this strategy, we presume, was its ability to engage the learners into a relevant, authentic learning scenario that provided situated cognition. This strategy exposed the learners to intricacies of critical thinking and, similarly to the debate strategy, resulted in higher levels of cognitive presence.

Looking at the characteristics of these strategies, one may conclude that the complexity of a discussion strategy is a result of interacting elements germane to the discussion task, demanding a deep and sustainable interaction. We speculate that the interacting elements require the learners to construct causal explanations for the processes generated by that interaction. The findings of this study seem to indicate that when participants face their counterparts who address the same complex scenario with different causal reasoning, their exposure to multiple perspectives extends their understanding of the problem and expands their cognitive presence for resolving it.

## Limitations

Student attrition was one of the problems which we were unable to control and which resulted in different group sizes. The instructor's policy provided the students with a choice of participating in 10 out of 12 discussion sessions. This particular topic, around which the discussion was designed, was scheduled for the latter part of the semester. We recognize the illuminating potential of demographic variables for further interpretation of our results. Information such as students' gender, Internet connectivity, experience with online learning, prior knowledge and epistemic beliefs might have added to our findings. However, this study was only exploring the contribution of these strategies to the learning outcomes of online discussion. Further research should follow to examine the effect of demographic variables.

## Conclusions

These findings are instrumental in narrowing the gap between face-to-face instruction and online learning by initiating the development of a heuristic for designing online discussions. The findings also indicate that a discussion strategy engaging learners in meaningful interaction and instructional experiences should contribute to learners' achievement of higher-level learning. For example, when the learning material is first being introduced, the instructor should provide the learners with pre-structured threads to guide the learner within the model of practical inquiry starting with triggering events. After initial discussion, the learners may feel more comfortable with the material and the process, and they can continue discussing given a role-play or forced debate discussion task. With a discussion situated in an authentic task, the learners are free to explore the material and integrate their findings through group discussion. To prevent learners from abandoning their efforts and to encourage them to fully think through their assumptions and findings, a mentor or the instructor should scaffold the discussion by posting meaningful questions and leading the discussion towards resolution and consensus.

Although this is not a model for designing asynchronous online discussions, this heuristic allows the dynamic phases of cognitive presence to evolve, in which the learner is exposed to all strategies and can flow from one phase to another and back to previous phases when necessary. For example, learners may state a hypothesis and test it in the integration phase only to find that they must clarify more information, as in the triggering event phase.

Such considerations should be taken when designing discussions and interactions using Web 2.0 tools, social media and other technologies, such as the microblogging service Twitter (Dunlap & Lowenthal 2009), which can be used for collaborative information sharing, knowledge creation, and problem solving (Brooks 2009; Lewis *et al*. 2010). Such informal learning spaces have been found to be more engaging than the traditional asynchronous format (Bhattacharya & Moallem 2009). However, in designing strategies to promote social presence, an important component of the community of inquiry approach (Garrison *et al*. 2001), one should not lose sight of the importance of cognitive presence. We contend that learning activities using social media should be carefully crafted while considering the entirety of the community of inquiry framework so as not to engage students and create a social presence without reaching the latter phases of cognitive presence. The more complex and engaging strategies, like the role-play and debate strategies presented here, should be tested using social media and further evaluated using this theoretical framework.

To note a few implications of these findings for further research, we recommend that the phases of cognitive presence and their relationships to higher levels of learning be more closely examined. Discussion strategies should be designed to promote progression through the phases of cognitive presence with the intention of contributing to higher-level learning. In such application, cognitive presence can be used as the theoretical framework and its phases as criteria for assessment of online discussion strategies.

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