Understanding cognitive presence in an online and blended community of inquiry: Assessing outcomes and processes for deep approaches to learning

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Abstract

This paper focuses on deep and meaningful learning approaches and outcomes associated with online and blended communities of inquiry. Applying mixed methodology for the research design, the study used transcript analysis, learning outcomes, perceived learning, satisfaction, and interviews to assess learning processes and outcomes. The findings for learning processes and outcomes indicated that students in both online and blended courses were able to reach high levels of cognitive presence and learning outcomes. The results suggest that cognitive presence in a community of inquiry is associated with perceived and actual learning outcomes. It is recommended that future research efforts focus on quantitative measures to establish links between cognitive presence and the quality of learning outcomes.

Introduction

Early research into computer conferencing and online learning focused on whether we could create social presence in a medium that was bereft of visual cues (e.g., Gunawardena & McIsaac, 2003; Gunawardena & Zittle, 1997; Tu & McIsaac, 2002; Tu, 2000). While this question has essentially been answered in the affirmative, the current challenge for researchers in online and blended learning has shifted to understanding cognitive presence issues (Garrison & Cleveland-Innes, 2005). In this regard, one of the pressing questions is whether higher-order learning can be achieved in an online or blended context. To date, the study of the quality of online and blended learning outcomes has been largely assessed through the perceptions of the participants; that is, student satisfaction and perceived learning (e.g., Richardson & Swan, 2003; Shea, Li & Pickett, 2006). The primary reason for this is that it is enormously challenging to
measure the depth of understanding of course-specific learning outcomes. Moreover, few studies have attempted to explore holistically the interactive and collaborative dynamics of the educational experience and epistemological learning outcomes (Garrison & Arbaugh, 2007).

Traditional higher education has long held that a community of scholars and inquiry is the ideal for the construction of deep and meaningful knowledge (Lipman, 1991; Ramsden, 2003). Considerable effort has been devoted to studying the creation and maintenance of an online community of learners (Garrison & Arbaugh, 2007). Notwithstanding the strengths of online communities to support higher levels of learning through sustained discourse and reflection, assessing the quality of learning outcomes associated with deep approaches to learning has been an ongoing challenge. The point is that we need to focus on assessing actual learning outcomes in order to associate depth of learning with interactive and collaborative approaches to online and blended learning. If we are to understand how to support cognitive presence in online and blended learning communities, then greater focus needs to be placed on linking processes and outcomes.

The purpose of this research is to provide a comprehensive review of processes and outcomes in online and blended educational communities of inquiry. The main research question is whether online and blended collaborative communities of inquiry can create cognitive presence that supports higher-order learning processes and outcomes. Secondary questions are as follows: (1) Is cognitive presence associated with perceived learning outcomes and grades? and (2) Are there differences between online and blended design approaches in terms of the strength of cognitive presence and perceived learning outcomes and grades? The study uses transcript analysis, learning outcomes (grades), perceived learning and satisfaction, and interviews to assess learning processes and outcomes (i.e., cognitive presence).

**Theoretical framework**

There are two theoretical thrusts relevant to this study. The first is a framework that provides order and guidance into the complexities and dynamics of online and blended learning environments. This is the Community of Inquiry (CoI) framework. The second perspective that provides theoretical and practical insight to the particulars of this study is the work on deep and surface learning approaches and outcomes.

**CoI framework**

Educational outcomes are dependent upon the complex dynamics of the purposes, design and interactions within the educational environment. This is made even more complex when studying the quality of latent cognitive learning outcomes (Garrison & Anderson, 2003). For this reason, it is imperative that we begin with a coherent framework that can provide the order and structural elements of a community of inquiry intended to support higher-order learning outcomes.
The CoI framework was first proposed by Garrison, Anderson and Archer (2000). The philosophical premise of the framework is a collaborative constructivist approach to teaching and learning. At the core of the CoI framework is deep and meaningful learning. There are three interdependent structural elements of the framework—social, cognitive and teaching presence. Social presence reflects the development of climate and interpersonal relationships in the community. Cognitive presence provides a description of the progressive phases of practical inquiry leading to resolution of a problem or dilemma. Teaching presence provides leadership throughout the course of study.

Since the focus of this study was on cognitive processes and learning outcomes, it is necessary to describe in detail the cognitive presence construct. Garrison et al (2001) describe cognitive presence as ‘the extent to which learners are able to construct and confirm meaning through sustained reflection and discourse in a critical community of inquiry’ (p. 11). Garrison and colleagues (2001) operationalised cognitive presence in terms of the practical inquiry model (see Figure 1). The phases of practical inquiry are defined in terms of triggering event, exploration, integration and resolution. The two axes that structure the model are action–deliberation and perception–conception. The first axis is reflection on practice. Reflection and practice together constitute the shared and personal worlds. The second axis is the assimilation (analysis) of information and
the construction (synthesis) of meaning. The quadrants reflect the logical or idealised sequence of practical inquiry (ie, critical thinking) and correspond to the categories of cognitive presence (Garrison et al, 2000).

The practical inquiry (PI) model includes four phases in describing cognitive presence in an educational context generally and online learning specifically (Garrison & Anderson, 2003).

1. Triggering event: This phase initiates the inquiry process through a well-thought out activity to ensure full engagement and buy-in from the students. This has several positive outcomes in terms of involving students, assessing the state of knowledge and generating unintended but constructive ideas.
2. Exploration: This phase focuses first on understanding the nature of the problem and then searching for relevant information and possible explanation.
3. Integration: This phase moves into a more focused and structured phase of constructing meaning. Decisions are made about integration of ideas and how order can be created parsimoniously.
4. Resolution: This phase is the resolution of the dilemma or problem, whether that is reducing complexity by constructing a meaningful framework or discovering a contextually specific solution. This confirmation or testing phase may be accomplished by direct or vicarious action.

Deep and meaningful approaches

Deep and meaningful learning approaches and outcomes associated with the CoI framework is founded on the seminal work of Marton and Saljo (1976). These researchers studied the strategies students used to approach learning and associated these findings with the qualitative differences in learning outcomes. Marton and Saljo found two levels of student information processing that they labelled as deep and surface. The intent of students in deep approaches to learning was to comprehend the meaning of the material. On the other hand, surface approaches to learning were characterised as reproductive and unreflective (ie, rote learning). They further described the educational context and conditions that promoted either deep or surface learning. They found that expectations (eg, nature of tests) and questioning (eg, interaction) had a considerable effect on student approaches to learning.

The important finding here is that when students approach learning in a deep manner, learning outcomes were qualitatively enhanced; that is, the quality of outcomes were of a higher order. Other researchers confirmed this research and extended it to include quantitative measures (Biggs, 1987; Entwistle & Ramsden, 1983). Process and outcome are intimately associated. As Marton (1988) states, ‘what is learned (the outcome or the result) and how it is learned (the act or the process) are two inseparable aspects of learning’ (p. 53). Collaborative constructivist assumptions associated with the CoI framework are consistent with the conditions associated with deep and meaningful approaches and learning outcomes (Garrison & Archer, 2000). The CoI framework is a dynamic model of the necessary core elements (social, teaching and cognitive
presence) for both the development of community and the pursuit of inquiry, which are required for higher-order learning (Swan, Garrison & Richardson, 2009).

The role of structured collaboration on higher-order thinking was also highlighted in a study by Garrison and Cleveland-Innes (2005) that explored the conditions in which deep learning emerges in an online collaborative environment. Garrison and Cleveland-Innes (2005) suggested that high levels of critical thinking and learning is dependent on structured and coherent interaction or discourse. The Study Process Questionnaire (Biggs, 1987), used to measure approaches to learning, was administered to online course participants in four graduate courses that were selected based on differences in required interaction and instructor presence. Findings suggested that interaction by itself does not promote deep approaches to learning. It was concluded ‘that the quality of interaction (ie, critical discourse) must be a specific design goal and interaction facilitated and directed in a sustained manner if deep approaches to learning are to be achieved’ (p. 142). Deep learning would appear to be associated with the quality of the engagement and suggests focused and coherent collaborative communities of inquiry.

**Review of the literature**

Asynchronous online discussions have gained considerable interest among educators and researchers in terms of designing and facilitating deep and meaningful approaches to learning. A number of models and tools have been developed in order to analyse discussions to illuminate cognitive activity, to measure higher levels of learning, or to examine the relationships between interaction and learning (eg, Bloom, 1956; Desanctis, Fayard, Roach & Jiang, 2003; Gunawardena, Lowe & Anderson, 1997; Henri, 1992; Luebeck & Bice, 2005; Murphy, 2004; Redmond & Lock, 2006).

One of the promising approaches used to evaluate higher-order learning is the PI model. The PI model has been studied along with other models (Buraphadeja & Dawson, 2008; Cotton & Yorke, 2006; Meyer, 2004; Schrire, 2004, 2006). Schrire (2004) found that the PI model ‘to be the most relevant to the analysis of the cognitive dimension and represents a clear picture of the knowledge-building processes occurring in online discussion’ (p. 491). More specifically, synergistic interaction (focused and coherent forms of student–student communication) was found to be significantly associated with higher-order thinking (ie, integration and resolution) as defined by the PI model. She also stated that her findings support the view ‘that instructional approaches encouraging collaboration among learners are more effective than instructional approaches based on individual learning ... [and] the findings fit social constructivist theories ...’ (p. 494). Consistent with the deep and surface research, Schrire (2006) concluded in a subsequent article, ‘the findings suggest that the achievement of synergistic interaction in computer conferencing leads to deeper learning ...’ (p. 67). Recently, Buraphadeja and Dawson (2008) also indicated that along with other models, the PI model in the community of inquiry is suitable for assessing critical thinking, as the community of inquiry framework has been continually developed and has been widely cited in the literature.
In addition to the analysis of online discussion, the literature has reported using self-report of learning and satisfaction to assess online learning (Richardson & Swan, 2003; Rovai, 2002; Shea et al, 2006). Both the actual grades and perceived learning have been used in some studies to explore the impact of different instructional approaches (see Benbunan-Fich & Arbaugh, 2006) or different delivery format on learning (Lim, Morris & Kupritz, 2007; Roblyer, Freeman, Donaldson & Maddox, 2007). With regard to perceived learning, Rovai (2002) asserts that using grades to operationalise learning may not always provide the best results. He recommends using self-report measures to operationalise cognitive learning instead of using grades. Verduin and Clark present a counter argument about perceived learning claiming that ‘the perceptions of various objects and events in adults’ environments can have a strong impact on the total behavior of adults and can therefore cause adults to move in one direction or another’ (Verduin & Clark, 1991, p. 141). Notwithstanding the limitations of self-report measures, the value of perceived learning and satisfaction findings are not clear.

Schrire (2006) emphasised using multiple approaches or tools in order to reflect the complexity of the cognitive dimension and knowledge building processes and outcomes. However, the literature review conducted by the authors here did not yield a study which used different sources of data together to reflect cognitive presence in an online or blended learning environment. In this regard, Rourke’s (2008) synthesis of learning in a community of inquiry revealed the need for more robust studies to provide the ‘how’ and ‘what’ of learning. Considering these issues, this paper aims to provide a more comprehensive understanding of cognition by exploring the ‘how’ and ‘what’ of learning (both processes and outcomes). To do so, the study used asynchronous online discussions, perceived learning and satisfaction, as well as learning outcomes.

**Methodology**

The main research question is whether online and blended collaborative communities of inquiry can create cognitive presence that supports higher-order learning processes and outcomes. In order to provide an in-depth understanding of learning, this study applied a mixed methodology approach. Enabling multiple data collection and the use of different strategies and methods, mixed method research provides better inferences and increased validity and reliability by eliminating limitations of each single method (Creswell, 2003; Johnson & Onwuegbuzie, 2004; Tashakkori & Teddle, 2003). Specifically, the study applied the concurrent triangulation strategy, which is one of the most familiar of the six major mixed methods models. In a concurrent triangulation strategy, the researcher uses two different methods—qualitative and quantitative—in an attempt to confirm, cross validate, or corroborate findings within a single study. Qualitative and quantitative data collection is concurrent, and ideally, the priority is equal distributed across the two methods. Interpretation can note convergence or the findings as a way to strengthen knowledge claims or explain any lack of convergence (Creswell, 2003). The study uses transcript analysis, learning outcomes, perceived learning, satisfaction, and interviews to assess learning processes and outcomes (ie, cognitive presence).
The research context of this study was a graduate course on the topic of blended learning. The course was delivered online in the fall term of 2007, and in a blended format in the winter term of 2008. Both methods of delivery were the focus of this study. The course was designed and organised on the basis of the CoI framework. That is, learning activities, strategies and assessment techniques were all developed to reflect social, cognitive and teaching presence. The major assignments were article critiques and peer reviews, weekly online discussions (9 weeks of discussion in each course), and prototype course redesign projects designed to provide an opportunity for students to begin redesigning a course or program for blended learning. One of the key components of this assignment was that students ‘articulate the theoretical framework for their redesign process’. Therefore, various frameworks, including the CoI framework, were covered in one lesson of the course. Some students selected the CoI framework, but others used frameworks that they were familiar with. Having been introduced to the CoI framework created an advantage when students were interviewed in that they were familiar with the CoI framework and were better able to understand the interview questions and provide coherent responses to those questions.

As an example of how each of the presences were designed into the course, social presence was created by a warm welcome by the instructor in the first synchronous meeting (face-to-face in blended course and through Elluminate in online course), and reinforced via students’ home pages and collaborative activities throughout the course. Cognitive presence was created and sustained when the instructor modelled how to facilitate the discussion in an effective way and when students felt comfortable to express and share their ideas in order to construct the knowledge and skills needed to apply for their article critique assignment and course redesign prototype project. In order to distribute teaching presence among students and teacher, students were responsible to facilitate and direct the online discussions in each of the remaining weeks. The premise was that distribution of teaching presence through student moderation can attenuate the authoritative influence of a teacher and encourage freer discussion (Rourke & Anderson, 2002).

Participants
The participants of the study were 15 students in the online course, and 12 students in the blended course. Only one student in the online course did not consent to participate in the study. There were six male and nine female students in the online course, and six male and six female students in the blended course who completed the survey. Eleven students from the online course and nine students from the blended course participated in the interviews. The demographic data shows that all the students were mature, mostly over 30 years of age in both courses. Apart from six students who live in Calgary, most of the students in the online course live in other cities and other states, whereas all students in the blended course live in Calgary. All the students in the online course were enrolled in a Master of Education graduate program. Eight students in the blended course were in the Master of Education program—only four were in different programs. Most of the students (12 in the online course; 7 in the blended course) have previous
online/blended learning experience, and some of them (8 in online course) had taken all previous courses in online/blended environments.

Data collection and analysis

Four data sources were used in this study: transcript analysis of asynchronous online discussions, students’ responses to a CoI survey, students’ achievement scores, and follow-up interviews with students and the course instructor. Transcript analysis of 9 weeks of discussions in each course was conducted in order to explore students’ level of cognitive presence utilising the PI model and coding indicators (Table 1). The first author and a research assistant applied the transcript analysis after training and pilot coding two discussions. The interrater reliability of the coders was 0.75 before they started actual coding. The researchers applied a negotiated coding approach in which the researchers coded transcripts, and then actively discussed their respective codes to arrive at a final assessment of the code (Garrison, Cleveland-Innes, Koole & Kappelman, 2006). Negotiation provided a means for ongoing training, refining the coding scheme, controlling for simple errors, and thereby increasing reliability.

A CoI survey instrument, was also administered at the end of the semester to explore student-perceived learning and satisfaction as well as their perceptions of each presence. The CoI survey was developed and validated by Arbaugh et al (2008). Cronbach’s alpha was 0.94 for teaching presence, 0.91 for social presence and 0.95 for cognitive presence. The CoI Survey included teaching presence perception (13 items), social presence perception (9 items), cognitive presence perception (12 items), one item for perceived learning and one item for perceived satisfaction. The items were measured on a 5-point Likert-type scale, with 1 = strongly disagree and 5 = strongly agree. Apart from one student in online course, all the students completed the survey.

Besides students’ self-report of learning, their actual learning outcomes in the form of grades were also used in the study. The actual learning outcomes were student final
grades comprised of 25% article critique assignment, 25% online discussion activity and 50% course redesign prototype project. Structured interviews with students at the end of each semester and an unstructured interview with the course instructor 3 weeks after the winter term ended were conducted in order to obtain detailed information about learning in a community of inquiry. Apart from four students, all student interviews were done using Elluminate. Elluminate was more convenient, and students were familiar with the use of synchronous online meetings. Students were asked about their sense of each presence in the course and how each presence influenced their learning and satisfaction. A qualitative content analysis method (Maxwell, 1996) was used to identify emerging themes from the interview data.

**Results**

The findings are presented under two main headings: learning processes and learning outcomes. Under learning processes, the results of the transcript analysis of weekly online discussions, along with interview results, were reported to reflect students’ cognitive presence throughout the course. For learning outcomes, students’ perceived learning, actual grades and perceived satisfaction obtained through CoI survey, along with interview results, were reported.

**Learning processes**

Students’ level of cognitive presence throughout the course was explored by analysing the 9 weeks of discussions in both courses. In order to explore students’ level of cognitive presence, the messages that the course instructor or the guest speakers posted were excluded from the analysis. The total number of messages that students posted was 564 in the online course, and 439 in the blended course. However, it is important to note that the average number of postings per student was almost the same in each course: 4.3 in the online course and 4.1 in the blended course.

Cognitive presence was analysed utilising the PI model. The first phase of cognitive presence is a triggering event that was coded when there is an indicator of recognising a problem or sense of puzzlement. For the exploration phase, the indicators were divergence among group members in the online community, divergence within a single message, information exchange, suggestions for considerations, brainstorming and leaps to conclusions. The third phase is the integration phase, which is found as convergence among group members, convergence within a single message, connecting ideas, synthesis and creating solutions. The highest level of cognitive presence is the resolution phase, where messages included vicarious application to real-world testing solutions and defending solutions. (See Appendix B for the examples of each phase of cognitive presence found in online discussions in each course.) The total number of messages with cognitive presence indicators posted by the students is 507 for the online course, and 371 for the blended course. Table 2 below illustrates the coding results for categories of cognitive presence over the three segments of time in both courses. As the distribution of percentages for each category of cognitive presence showed, the integration phase was the most frequently coded category of messages posted by students in
both courses. This means that students in both courses were able to integrate information from various sources, develop justified hypotheses, build on each other’s ideas or create solutions.

The analysis of interview data also supports the high level of cognitive presence in each course. Almost all students in both courses indicated that they perceived cognitive presence to be strong in the course, and most of the students believed that they were able to reach the phases of integration and resolution. However, most of them thought that resolution is achieved individually through their final projects. One student indicated that the course set the students up to have the ability to reach the resolution phase and said ‘within the course the students were pretty close to resolution phase but the resolution phase definitely will be cemented when they actually implement course redesign projects’.

One student’s comment was, ‘the cognitive presence was probably the best part, because the way the course was structured and designed, I felt like I was actually constructing my knowledge of blended learning as I was going through the course’. Another student described cognitive presence as the challenging and intellectual content of the course.

Students’ comments about cognitive presence noted the importance of resources and learning activities in order to develop deep approaches to learning in both courses. They described learning activities as relevant, challenging, collaborative and engaging. The students valued group work, and some also expressed their preference of more group work activities. The instructor also emphasised the role of learning activities. He said ‘if you do not have the activities that are directed to push students intentionally through four phases of inquiry model, learning does not happen’. He stated that activities were designed to move students through the phases of practical inquiry, ultimately to take them through redesign process, force them to make decisions and apply what they were learning in the class.

**Learning outcomes**
The descriptive analysis of survey data showed that students had high perceptions of their learning and satisfaction in both courses (Table 3). However, as seen in Table 3,
the students in the blended course have slightly higher perceptions of cognitive presence, learning and satisfaction compared with the students in the online course. Students’ final grades in both courses were essentially identical. The means of final grades were 94.2 for the online course and 93.8 for the blended course. Due to the small sample size, both the independent ‘t-test’ and Mann–Whitney U-test were conducted to explore whether these differences were statistically significant. As seen in Table 3, the ‘t-test’ did not yield a significant difference between the online and blended courses in terms of students’ perceived cognitive presence ($p = 0.209$), learning ($p = 0.154$) and satisfaction ($p = 0.207$). The results of Mann–Whitney U-test were consistent with the ‘t-test’ results that did not reveal any statistically significant differences. The survey analysis also showed a higher perception of the other two community of inquiry presences (social and teaching) in both courses, but relatively higher perceptions in the blended course. For teaching presence, the mean was 4.15 for the online course and 4.51 for the blended course. For social presence, the mean was 3.94 for the online course and 4.3 for the blended course.

Further analysis was conducted to explore the relationships among perceived cognitive presence, learning and satisfaction. The Spearman rank correlation coefficient showed that perceived level of cognitive presence is associated with perceived learning and satisfaction in both courses. The correlation coefficient was found to be significant between cognitive presence and learning ($r = 0.67$, $p = 0.007$ in online course; $r = 0.81$, $p = 0.001$ in blended course) and between cognitive presence and satisfaction ($r = 0.65$, $p = 0.009$ in online course; $r = 0.64$, $p = 0.024$ in blended course).

All the students interviewed expressed a high degree of perceived learning in their courses. The instructor of the courses also expressed satisfaction with the level of online discussions and quality of final projects in both courses. The final project was especially valued by all students; they assessed the project as relevant, authentic, practical and challenging. One student stated that it was the synthesis, evaluation and practical summary of everything that went on in the class. According to the course instructor, the course redesign project was the true measure of cognitive presence, as it actually showed how students internalised the knowledge and how they went through the process.

With regard to the impact of each presence, students indicated different levels of impact for each of the presences (social, cognitive, teaching) on perceived learning and satisfaction. In terms of their previous experiences and preferences, students explained why

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Table 3: Students’ perception of cognitive presence, learning, and satisfaction

<table>
<thead>
<tr>
<th></th>
<th>Perceived cognitive presence</th>
<th>Perceived learning</th>
<th>Satisfaction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Online course</td>
<td>4.07</td>
<td>4.20</td>
<td>4.47</td>
</tr>
<tr>
<td>Blended course</td>
<td>4.31</td>
<td>4.58</td>
<td>4.75</td>
</tr>
<tr>
<td>Significance</td>
<td>$p = 0.209$</td>
<td>$p = 0.154$</td>
<td>$p = 0.207$</td>
</tr>
</tbody>
</table>

certain presences or the community of inquiry as a whole are important. For some students, all three presences were important for learning, whereas some students indicated one or two presences essential for their learning and satisfaction. For example, based on previous online course experience, one student from the blended course stated that she could not think of the presences separately in terms of their effect on learning and said, ‘if one of those presences is missing, you do not get the same degree of inquiry’. Another student from the online course identified social presence as irrelevant in this kind of learning environment said, ‘... I am not there to create a network or to meet other people; [I am here] to get something very specific done’. However, most students appreciated the course design, and 18 students in both courses stated that they would definitely suggest this course to others for the following reasons: (1) they learned a lot in the course; (2) they found the course interesting, valuable, worthwhile, well designed and well facilitated; and, 3) they thought the topic was important and worthwhile.

Discussion
This paper aimed to enhance our understanding of learning in online and blended learning environments by utilising a wide range of data sources to show each aspect of learning. In both environments students’ level of cognitive presence revealed in online discussions was found to be high. Contrary to previous studies (Garrison et al., 2001; Kanuka, Rourke & Laflamme, 2007; McKlin et al., 2001; Meyer, 2003; Pawan, Paulus, Yalcin & Chang, 2003; Vaughan & Garrison, 2005), the integration phase was found to be the most active in both online and blended environments. At the same time, the resolution phase had the least activity. However, these findings are explainable as the result of the instructional design of both courses. The explanation is that resolution thoughts was directed to each of the student’s individual course redesign project. This was confirmed through the interviews, when students stated that they reached resolution by applying solutions to their course redesign projects developed in the integration phase. The instructor of the course also emphasised the importance of the course redesign assignment to have the students’ reach the resolution phase.

While the course design encouraged students to move to higher levels of cognitive presence (eg, resolution), it should be noted that time was identified as a barrier in online discussions in terms of reaching resolution. Therefore, it may be that the length of the course is not sufficient for students to put their projects in action and share the application results with the other students. Considering these findings, it can be concluded that the online discussion board is an effective tool to represent students’ level of cognition during the learning process; however, because of some contextual constraints, such as design and time, the discussion was not sufficient to demonstrate the final phase of cognitive presence (ie, resolution) thoroughly.

In terms of learning perception, the results indicate that students in both courses believed that there was a high degree of learning. Consistent with a high perception of learning, students’ grades were also high in both learning environments. Another interesting result was the relationship between students’ perceived level of cognitive presence (ie, practical inquiry) and their learning. Given that all findings related to
learning were high, it can be concluded that cognitive presence in a community of inquiry is strongly associated with high levels of perceived learning. It is suggested that collaborative development of cognitive presence in online discussions and students’ perception of cognitive presence is associated with high perceptions of learning and actual learning outcomes in terms of grades. This study affirms structured collaborative activities for deeper and meaningful learning as suggested previously (Garrison & Cleveland-Innes, 2005; Schrire, 2006). Moreover, a recent study indicated that epistemic engagement in which the students become collaborative knowledge builders is well articulated and extended through the CoI framework (Shea & Bidjerano, 2009). The study of Benbunan-Fich and Arbaugh (2006) also confirmed the ascendency of collaborative constructivist approaches. The authors found evidence to suggest that group collaboration or knowledge construction can potentially improve students’ perceived learning and final grades.

Overall, the results suggest that students in both courses were able to reach high levels of cognition. However, there were also some differences found between online and blended learning courses. First, it is interesting to note that students in the blended course had higher perceptions of learning, satisfaction, cognitive presence, teaching presence and social presence. These results are in contrast to the findings of Lim et al (2007), who did not show a difference on perceived learning between blended and online learning environments. However, similar to their study, there was no difference on learning outcomes regarding course format. Another difference that is worth noting is the higher frequency of activity at the integration phase in the blended compared with the online course. The explanation for this difference is that students in the blended course started weekly discussions in face-to-face meetings. Therefore, much of the triggering events and exploration may have occurred during the face-to-face portion of the blended course. Taken together, these differences suggest that the blended course format may have provided better conditions for higher-order thinking. Garrison and Kanuka (2004) also assert that blended learning is particularly effective to facilitate a community of inquiry by adding an important reflective element with multiple forms of communication to meet specific learning requirements. At the same time, this did not affect the final grades of the students, which may have been an artifact of the assignment and the grading rubric.

Measuring higher-order learning outcomes is inherently challenging. The main reason for this is that we are attempting to objectively measure latent, complex cognitive states. Secondarily, while it may be possible to measure higher-order subject specific learning outcomes, invariably, this is not practical from a time perspective in a normal educational context. It is suggested here that future research should focus on finding indirect, proxy measures for learning outcomes that demonstrates a link between approaches to learning (ie, process) and higher-order epistemological outcomes. The seminal research by Marton and Saljo (1976) has provided qualitative evidence of this link between process (approach) and outcomes. Future research might focus on validating links between quantitative measures of educational processes and learning outcomes.

The approach here was to use the PI model (i.e., cognitive presence) to explore process relationships to learning outcomes. The PI model has shown promising results previously and here as a tool to explore cognitive presence and the learning process (Pawan et al., 2003; Schrire, 2004, 2006). With the recent development of the CoI survey (Arbaugh et al., 2008), quantitative measures of cognitive presence are possible. This instrument could be used to explore links between learning processes and indirect quantitative measures associated with deep and meaningful learning outcomes. Ultimately, the goal is to demonstrate that processes described by the PI model are associated with actual higher-order learning outcomes and proxy measures, such as perceived learning and instruments that measure deep approaches to learning. It is interesting to note a simplified version of the study process questionnaire (Biggs, 1987) consisting of 20 items measuring deep and surface approaches should be considered for research purposes (Biggs, Kember & Leung, 2001). One final comment, in order to provide a holistic understanding of learning, it is recommended that researchers continue to examine both self-reports of learning and actual grades as they are likely measuring different aspects of learning processes and outcomes.

**Conclusion**

The implication is that there is a strong relationship between collaborative constructivism and higher-order learning outcomes. The strength of the community of inquiry framework is its emphasis on collaborative constructivist approaches for designing learning environments in order to provide deep and meaningful learning experiences. However, as several students suggested, it is important that all the presences are present and in balance. Establishing and sustaining cognitive presence and deep approaches to learning in online and blended learning environments are dependent upon a dynamic balance of all the presences to support a collaborative community of inquiry. The results of this study cannot be generalised due to the small sample size. Also, as indicated by Akyol, Vaughan and Garrison (in press), students’ characteristics, their experience in online and blended learning environments, or their approach to learning, might influence the development of a community of inquiry, which in turn might affect both learning processes and outcomes.

We are beginning to understand collaborative practices, but we have not yet provided satisfactory links between collaborative approaches to learning and higher-order learning outcomes. If we are to better understand epistemological issues with regard to collaborative constructivist approaches to learning and communities of inquiry, then we must begin to answer the questions posed by Hannafin and Kim (2003): ‘What has been learned? [and] How did understanding evolve?’ (p. 348). In response, it is suggested that deep approaches to learning may provide a profitable means of addressing the first question, while the CoI framework and its dynamics has shown considerable promise to address the second question.

**References**


**Appendix**

**Table 1A: Community of inquiry questionnaire**

<table>
<thead>
<tr>
<th>Strongly disagree</th>
<th>Disagree</th>
<th>Neutral</th>
<th>Agree</th>
<th>Strongly agree</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Teaching presence</strong></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The instructor clearly communicated important course topics</td>
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<tr>
<td>The instructor clearly communicated important course goals</td>
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<tr>
<td>The instructor clearly communicated important due dates/time frames for learning activities</td>
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<tr>
<td>The instructor was helpful in identifying areas of agreement and disagreement on course topics that helped me to learn</td>
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<tr>
<td>The instructor was helpful in guiding the class towards understanding course topics in a way that helped me clarify my thinking</td>
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<tr>
<td>The instructor helped to keep course participants engaged and participating in productive dialogue</td>
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<tr>
<td>The instructor helped keep the course participants on task in a way that helped me to learn</td>
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<tr>
<td>The instructor encouraged course participants to explore new concepts in this course</td>
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<tr>
<td>Instructor actions reinforced the development of a sense of community among course participants</td>
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<tr>
<td>The instructor helped to focus discussion on relevant issues in a way that helped me to learn</td>
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<tr>
<td>The instructor provided feedback that helped me understand my strengths and weaknesses</td>
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<tr>
<td>The instructor provided feedback in a timely fashion</td>
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</table>

| **Social presence** |            |          |       |               |
| Getting to know other course participants gave me a sense of belonging in the course | | | | |
| I was able to form distinct impressions of some course participants | | | | |
| Online or web-based communication is an excellent medium for social interaction | | | | |
| I felt comfortable conversing through the online medium | | | | |
| I felt comfortable participating in the course discussions | | | | |
| I felt comfortable interacting with other course participants | | | | |
Table 1A: Continued

<table>
<thead>
<tr>
<th></th>
<th>Strongly disagree</th>
<th>Disagree</th>
<th>Neutral</th>
<th>Agree</th>
<th>Strongly agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>I felt comfortable disagreeing with other course participants while still maintaining a sense of trust.</td>
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<tr>
<td>I felt that my point of view was acknowledged by other course participants.</td>
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<tr>
<td>Online discussions help me to develop a sense of collaboration.</td>
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<tr>
<td>Cognitive presence</td>
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<tr>
<td>Problems posed increased my interest in course issues.</td>
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<tr>
<td>Course activities piqued my curiosity.</td>
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<tr>
<td>I felt motivated to explore content related questions.</td>
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<tr>
<td>I utilized a variety of information sources to explore problems posed in this course.</td>
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<tr>
<td>Brainstorming and finding relevant information helped me resolve content related questions.</td>
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<tr>
<td>Online discussions were valuable in helping me appreciate different perspectives.</td>
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<tr>
<td>Combining new information helped me answer questions raised in course activities.</td>
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<tr>
<td>Learning activities helped me construct explanations/solutions.</td>
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<tr>
<td>Reflection on course content and discussions helped me understand fundamental concepts in this class.</td>
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<td>I can describe ways to test and apply the knowledge created in this course.</td>
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<tr>
<td>I have developed solutions to course problems that can be applied in practice.</td>
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<tr>
<td>I can apply the knowledge created in this course to my work or other non-class related activities.</td>
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<tr>
<td>Satisfaction</td>
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<tr>
<td>Overall, I was satisfied with this course.</td>
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<tr>
<td>Learning</td>
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<tr>
<td>I learned much in this course.</td>
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</tbody>
</table>

Table 2A: Examples of coding for each category of cognitive presence

<table>
<thead>
<tr>
<th>Phase</th>
<th>Response examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Triggering event</td>
<td>In education, there are desired goals although successful achievement for some might be challenging to measure (ie, critical thinking). Therefore, should the learner-centered model be implemented at the discretion of an instructor?</td>
</tr>
<tr>
<td>Exploration</td>
<td>First, I think resource barriers or at least spending limits are a good thing .... Second, I think that PD needs to be compulsory .... The first thing that comes to my mind is .... I have a similar experience in my .... Would you think of applying .... Moodle was implemented in our division three years ago. In the last year .... I was reading an article about .... and it says that ....</td>
</tr>
<tr>
<td>Integration</td>
<td>I’m assuming that you are referring to transformational learning as defined similarly by both Brookfield (2005) and Mezirow (1994). Although time and money help make ‘transformation’ possible, appropriate culture and leadership are the more critical ingredients (Fullan, 2001, 2005, 2006; Moss-Kanter, 2001; Senge, 1996). You can throw as much time and money at the people of an organization as you like but if the necessary culture and leadership are absent, change of the transformational variety is impossible let alone sustainable.</td>
</tr>
<tr>
<td>Resolution</td>
<td>I have noticed that by editing writing together on a projector, the students are engaged and involved in the process. We had a problem at school about students’ .... To solve this problem we developed .... And it worked, the students ....</td>
</tr>
</tbody>
</table>