Community of Inquiry Model: Advancing Distance Learning in Nurse Anesthesia Education

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The number of distance education courses offered by nurse anesthesia programs has increased substantially. Emerging distance learning trends must be researched to ensure high-quality education for student registered nurse anesthetists. However, research to examine distance learning has been hampered by a lack of theoretical models. This article introduces the Community of Inquiry model for use in nurse anesthesia education. This model has been used for more than a decade to guide and research distance learning in higher education. A major strength of this model lies in its direct applicability for guiding online distance learning. However, it lacks applicability to the development of higher order thinking for student registered nurse anesthetists. Thus, a new derived Community of Inquiry model was designed to improve these students’ higher order thinking in distance learning. The derived model integrates Bloom’s revised taxonomy into the original Community of Inquiry model and provides a means to design, evaluate, and research higher order thinking in nurse anesthesia distance education courses.

Keywords: Bloom’s revised taxonomy, collaborative learning, community of inquiry model, distance learning, higher order thinking.

Distance learning is an educational delivery method that is on the rise in higher education. Nurse anesthesia educational programs also have seen an increase in distance learning. The Council on Accreditation of Nurse Anesthesia Educational Programs has approved 58% of nurse anesthesia programs to offer distance learning courses and 10% to offer a distance education program.

Teachers need to be aware of the considerations for delivering education from a distance. The use of distance learning is challenging and requires teachers to rethink traditional learning practices. Teachers have used the “sage on the stage” approach, in which they present lectures and the student is responsible to learn the content. Face-to-face interaction in the classroom allows teachers to evaluate students’ learning via verbal and nonverbal cues. In contrast, distance learning challenges teachers to emphasize active student learning and rethink traditional pedagogy. A teacher’s assessment of student learning is complicated by lack of verbal and nonverbal cues. Teachers use collaborative learning strategies to guide students to be responsible for their own learning. Collaborative learning strategies include interactive student-centered activities whereby social processes facilitate learning. Teachers are challenged to incorporate interactive collaborative learning strategies and to rethink the process of student evaluation in distance learning.

Emerging trends in teaching and learning strategies require a process of evaluation to ensure quality nurse anesthesia education. However, research to examine distance learning strategies has been hampered by a lack of theoretical models. The purpose of this article is to propose the use of the Community of Inquiry (COI) model to guide, develop, evaluate, and research distance learning strategies in nurse anesthesia education. This article describes the original COI model (Figure 1), the collaborative learning process, and a derivation of the

Figure 1. Community of Inquiry Model
(From Garrison et al. Reprinted with permission from Elsevier.)
The Table lists definitions of key terms that are used in this article.3,4,9-12

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
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<tbody>
<tr>
<td>Asynchronous</td>
<td>Communication that does not occur in real time. Examples of asynchronous</td>
</tr>
<tr>
<td></td>
<td>teaching strategies include discussion forums, blogs, and wikis.4</td>
</tr>
<tr>
<td>Bloom’s revised taxonomy</td>
<td>Hierarchy of education objectives used by teachers to guide and evaluate</td>
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<tr>
<td></td>
<td>student learning. Terms in the taxonomy are action verbs that increase in</td>
</tr>
<tr>
<td></td>
<td>complexity as the hierarchy progresses. Main headings of the taxonomy</td>
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<td></td>
<td>include remember, understand, apply, analyze, evaluate, and create.10</td>
</tr>
<tr>
<td>Collaborative learning</td>
<td>Student learning that occurs as students work together socially in small</td>
</tr>
<tr>
<td></td>
<td>groups to negotiate and solve problems.3</td>
</tr>
<tr>
<td>Debate</td>
<td>Teaching strategy where teachers require students to construct solutions</td>
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<tr>
<td></td>
<td>and justify answers. The strategy requires learners to reason, defend</td>
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<tr>
<td></td>
<td>their position, and confront inconsistencies that are revealed by their</td>
</tr>
<tr>
<td></td>
<td>peers.11</td>
</tr>
<tr>
<td>Distance learning</td>
<td>Learning that occurs when there is physical separation between students</td>
</tr>
<tr>
<td></td>
<td>and teachers. Distance learning can be synchronous or asynchronous.12</td>
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<tr>
<td>Text-based</td>
<td>Learning that occurs in a written format with ample time for deep</td>
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<td></td>
<td>reflection by the learner.9</td>
</tr>
<tr>
<td>Traditional learning</td>
<td>Learning that is teacher-centered. The teacher becomes the “sage on the</td>
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<td></td>
<td>stage” and delivers information using a lecture format. The mode of</td>
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<tr>
<td></td>
<td>learning is between the student and teacher and the student and material.</td>
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<td></td>
<td>Limited learning occurs between students during the formal learning</td>
</tr>
<tr>
<td></td>
<td>process.3</td>
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</table>

### Community of Inquiry Model and Its Components

The COI model has been used as a theoretical framework to guide distance learning in higher education for over a decade. At the core of the COI model is the educational experience.

The COI model was developed for use in online text-based distance learning.5 Text-based distance learning occurs in a written format with ample time for deep reflection by the learner.9 The COI model’s theoretical foundations are based on the community of inquiry research by Lipman.13 A community of inquiry is defined as a group of learners who collaboratively construct meaning of concepts and ideas using meaningful discussion.3 Teachers use the COI model to design and guide student learning activities. The 3 main components of the model include: (1) social presence; (2) teaching presence, and (3) cognitive presence (see Figure 1).9

Social presence is defined as the ability of the student to relay characteristics of themselves in the online community.9 Social presence should not be confused with the act of interacting within a communication tool such as a discussion board. Rather, social presence is establishing a cohesive community and sense of belonging.5 Students must develop a sense of trust so that ideas can be exchanged comfortably. Teachers must incorporate strategies to facilitate social presence, such as promoting an online environment with mutual respect and trust where all ideas are considered viable for discussion.

Teaching presence is necessary to initiate the development of the COI. It is established when the overall direction to a course is given by the teacher.14 The teacher identifies relevant knowledge and then designs course activities to facilitate student learning.5 Teachers act as moderators to monitor discussions, prompt opinions, and ask probing questions.15 Teaching presence does not require the teacher to moderate all student discussions during a course. Teachers may assign students to play the moderator role for some learning activities. The role of the teacher is to assess efficiency and effectiveness of the learning activities rather than to lead them.14

Cognitive presence is defined as the intellectual environment necessary for the development of student learning.5 It is required for student knowledge construction and the development and application of higher levels of thinking.16 Cognitive presence is divided into 4 phases of inquiry: (1) triggering, (2) exploration, (3) integration, and (4) resolution.16 The phases of inquiry have been used to research student higher order thinking on discussion boards.11,16-18 Triggering is an issue, dilemma, or problem that emerges. A problem is recognized and a sense of puzzlement leads to more discussion.16 Exploration is the brainstorming phase of discussion. This is the search for relevant information for use by the group.16 Integration is the use of ideas generated in the exploration phase to construct meaning of concepts. Students reflect on ideas presented in the exploration phase. Ideas are assessed for logical connectivity to other information, such as textbooks, literature, and personal experience.16 Resolution of the problem or issue includes
the testing and defending of solutions that are created during integration. The phases of inquiry in cognitive presence reflect the collaborative learning process but are not an actual measure of an individual student’s learning outcomes. The 4 phases of inquiry reflect types of conversations and the components in the collaborative learning process. The teacher’s understanding of cognitive presence is essential to monitor and facilitate the student collaborative learning process.

The COI survey instrument was developed as a means to measure the 3 components of the COI model. The instrument was validated in health profession students enrolled in online courses offered in a college of health professions. The survey can be used to research distance learning in SRNAs. However, the limitations of the COI survey instrument include the ability to measure only student and faculty perceptions of the distance learning experience.

Collaborative Learning Process and Components

The collaborative learning process underpins the COI model. Teachers need to understand the collaborative learning process in order to develop quality distance learning activities or strategies. Collaborative learning is defined as a complicated, unique, student learning strategy that emphasizes a group educational approach. Group members work collaboratively to achieve a common goal and share experiences to construct and confirm meanings of concepts. Learning occurs when a group strives to achieve a shared understanding of a concept. Students reach solutions to problems by dividing tasks using social processes. Common group goals, interdependence, and mutual respect are essential. Mutual respect allows students to clarify reasoning and freely defend their understanding in group discussions.

Collaborative learning has been studied extensively in educational research and found to be an effective distance learning strategy. Although a Google Scholar and ERIC (Education Resources Information Center) database search for the term collaborative learning returned thousands of documents, the results were reduced to a few hundred documents when the term distance education was added; there were no results when the term anesthesia was included. A meta-analysis in the education literature concluded that collaborative learning using small student groups and technology facilitated student learning. Studies and subjects included in the meta-analysis were from all levels of education and from a variety of general education courses. Collaborative learning improved higher order thinking and learning outcomes. Collaborative learning significantly (P < .001) improved analysis, synthesis, and evaluation of concepts compared with individual learning. Collaborative learning significantly (P < .001) improved analysis, synthesis, and evaluation of concepts compared with individual learning.

**Figure 2. Collaborative Learning Process**

Green boxes denote the components, and white boxes denote outcomes at each stage of the collaborative learning process. Arrows note progression from phases of collaborative learning process to the outcomes. Individual process components and outcomes are synthesized from the work of Dewey (individual reflective thinking), Moshman and Geil (individual reasoning, individual perspectives, multiple perspectives, and collaborative reasoning), Jorczak (divergent thinking and convergent thinking), and Garrison (higher knowledge gain).
Together these processes lead to higher knowledge gain. The white boxes denote outcomes at each stage of the collaborative learning process. The arrows indicate progression through the phases of the collaborative learning process. The individual process components and outcomes are synthesized from the work of Dewey, Moshman and Geil, and Garrison.

The process begins with individual reflective thinking as described by Dewey. Reflective thinking is defined as active reflection and consideration of an idea in relation to the evidence that supports it. Initial ideas use information from individual experience and knowledge. Reflective thinking requires that an individual be open to the idea that there may be alternative explanations for his or her current beliefs and knowledge. Reflective thinking also requires the willingness to explore ideas and to find facts and evidence to support thinking. Thinking alone is merely a random flux of disconnected ideas. Reflection adds evidence and proof to thoughts. Once initiated, the process progresses to individual reasoning. Individual reasoning uses the reflective thoughts that were generated. Individual reasoning is a cognitive process that is performed by an individual to reach a justifiable conclusion to a problem. Individual reasoning leads to the formation of individual perspectives.

Divergent thinking begins with generation of an individual idea. Jorczak described divergent thinking as a trigger for conceptual conflict within a group. The process begins with the externalization of a concept or idea by a group member. Elaboration of the concept by the group generates additional perspectives. Conflict is generated as members realize that there are differences of opinions or understanding of concepts. Conceptual conflict facilitates learning by creating a problem that requires a solution. The COI model operationalizes cognitive presence using the phases of inquiry. The exploration phase is consistent with divergent thinking within the collaborative learning process.

Convergent thinking evolves from divergent group thinking. Jorczak described convergent thinking as an attempt to complete a task or resolve conceptual conflict by group members. Social processes are used to clarify and solve problems. Solutions to problems become apparent after considering all individual perspectives. Convergent thinking is likely to result in a similar understanding of a concept among group members. Convergent thinking uses group collaborative reasoning to find solutions to complex problems. Reasoning is the process of thinking for the purpose of coming to a conclusion.

Collaborative reasoning is the process whereby 2 or more individuals socially interact, reflect, and arrive at a shared conclusion. Students use the collaborative reasoning process to find solutions to problems by using knowledge that is contributed during peer interaction. Collaborative reasoning has been found to be superior to individual reasoning. Moshman and Geil examined the group collaborative reasoning process. Their initial framework was based on the idea that individuals lack the ability to correctly identify a false null hypothesis. Falsification of a hypothesis is the ability to generate evidence proving a hypothesis false rather than merely collecting evidence to prove the hypothesis true. The authors found that collaborative reasoning improved a group's ability to correctly solve falsification problems.

Moshman and Geil also reported that it was not always possible to find leaders within groups that were responsible for correct insights into problem solving. The authors attributed this situation to the fact that multiple perspectives are often needed when seeking proof and truth. The authors concluded that the comprehensive group perspective contributed the information needed to correctly solve complex problems. In addition, the group perspective is needed to close gaps that may exist in individual perspectives.

The integration phase in the COI model is consistent with convergent thinking in the collaborative learning process. Together, divergent thinking and convergent thinking lead to higher knowledge gain. All phases of the collaborative learning process underpin the COI model and influence the students' experience in distance learning education. The collaborative learning process leads students to construct new knowledge and confirm their understanding of concepts through peer interaction. Supporting discourse, selecting content, and setting climate all support the collaborative learning process and facilitate the educational experience that is at the core of the COI model.

**Using the Collaborative Learning Process to Guide Distance Learning.** Students use individual reflective thinking to help identify concepts for group discussion. Ideas are generated from the student's individual reasoning. Students use the knowledge and experience that they have of a concept to reflectively think about an idea and reason individually. For example, an individual student's initial idea is that a patient's ruptured appendicitis can lead to sepsis. The student generates the initial idea that the patient is septic by using individual reasoning that a ruptured appendix can lead to a systemic process and ultimately sepsis.

Group divergent thinking occurs when SRNAs share their individual perspectives with a discussion group. Foundational knowledge and prior experiential learning influence the formation of individual student perspectives. Foundational knowledge was gained from prior classroom learning at the undergraduate level and in the nurse anesthesia classroom. Experiential learning results from a quality experience followed by meaningful reflection. Experiential knowledge for the SRNA results from prior clinical and work in critical care. Work experiences in intensive care units provide a rich medium of knowl-
edge for students to share in asynchronous online activities that use written text-based communication.

An example of group divergent thinking is a group discussion of the patient with sepsis. Foundational knowledge of the pathology, presentation, and care of patients with sepsis begins in undergraduate nursing education. Additional foundational knowledge is gained in nurse anesthesia coursework with an in-depth study of sepsis. Experiential learning is gained from students’ past clinical experiences and work in critical care when caring for patients with sepsis. Students contribute their perspectives of the septic patient to the group discussion. Their perspectives differ based on prior knowledge and experiences.

The convergent thinking phase occurs when SRNAs analyze the information shared in the divergent thinking phase. Multiple perspectives of the group members are argued, and information is manipulated. An example of this phase is using the differing perspectives of sepsis presented by group members. One student’s perspective of sepsis may be that of the beginning stages of sepsis as defined by the systemic inflammatory response syndrome. A second perspective may be sepsis with single organ involvement. A third perspective may be septic shock with refractory hypotension, impaired tissue perfusion, and multiple organ dysfunction. The differing presentations of sepsis alter the anesthetic care plan for a patient. In the convergent thinking phase, the group manipulates and argues the information regarding different presentations of sepsis and the implications for anesthetic care. Information generated in the convergent thinking phase is then used for collaborative reasoning.

Collaborative reasoning uses the perspectives of all group members to solve complex problems. Problem-solving ability is improved with collaborative reasoning. The collaborative reasoning process leads to a shared understanding of a concept, improved problem solving, and higher knowledge gain by the group. An example of collaborative reasoning in the collaborative learning process is students using the information generated in the convergent thinking phase to formulate an appropriate anesthetic plan of care for patients who are septic and who present with multiple organ dysfunction and refractory hypotension. Using collaborative reasoning, the group is able to agree on the anesthetic plan of care for a critically ill patient by pooling, manipulating, and arguing all perspectives of the problem.

Need to Focus on Higher Order Thinking in Distance Learning

The American Association of Nurse Anesthetists (AANA) Foundation has selected a 2013 research priority to “Determine if critical thinking skills can be taught, measured and/or predicted.” A lack of appropriate theoretical models to examine critical and higher order thinking in distance learning makes this a difficult research priority to fulfill. A major strength of the COI model lies in its direct applicability to online, written text-based distance learning strategies. However, it lacks applicability to the development of higher order thinking.

Bloom’s revised taxonomy, has been used since the 1950s to guide and evaluate student learning. Higher order thinking has been defined as the upper levels of Bloom’s taxonomy (analysis, evaluation, and creation). This definition is appropriate for evaluating SRNAs’ higher order thinking and is a direct measure of student learning.

Studies have researched higher order thinking using the 4 phases of inquiry that operationalize cognitive presence. These studies defined higher order thinking as discussion “that is conceptually rich, coherently organized, and persistently exploratory.” This definition of higher order thinking is important to the development of how students learn. However, it is the authors’ opinion that this definition reflects the use of the collaborative learning process without focusing on students’ higher order thinking as it applies to knowledge gain. Akyol and Garrison note that objective measures of student learning are lacking. Based on the literature review, the authors also conclude that to date, no new models are available to guide research that objectively measures student learning, and hence they recommend future research that focuses on direct measures of student learning and its relationship to learning processes.

Derived Community of Inquiry Model That Incorporates Higher Order Thinking

The authors propose an innovative approach to resolve this gap. Integrating Bloom's revised taxonomy, an objective measure of student thinking, into the original COI model, creates the derived COI model (Figure 3). The incorporation of Bloom's revised taxonomy into the derived COI model provides the important ability to measure an individual student’s higher knowledge gain as an outcome measure. Bloom’s revised taxonomy has been used to measure student higher order thinking since 2002. Levels of thinking are ordered from least to most complex. This addition provides a means to evaluate and research whether higher order thinking can be taught, measured, and/or predicted in SRNAs by converting the abstract nature of the COI model into a new model with objective learning outcomes.

The derived COI model builds on the original COI model’s 3 main components. Cognitive presence reflects the collaborative learning process and is operationalized using the 4 phases of inquiry. The original COI model was changed to pictorially incorporate the phases of inquiry into the cognitive presence component. This derivation of the COI model is innovative because it enhances the model by allowing for direct comparisons between students’ use of higher order thinking and the collaborative learning process.
The derived COI model is ready for use to research SRNAs’ higher order thinking skills when using distance learning activities such as discussion boards, problem-based learning, and collaborative learning work groups. The model also can be used to research distance learning evaluation strategies, such as grading rubrics, and will lead to the development of psychometrically sound grading rubrics for evaluating students’ higher order thinking. Research that tests students’ higher order thinking is critical to evaluate the effectiveness of distance learning strategies.

Advancing Higher Order Thinking in Distance Learning

Distance learning serves an important role in nurse anesthesia education. Written text-based distance learning activities provide a means to deliver continuous learning in SRNAs during their entire program. Distance learning can bridge the gap between the front-loaded classroom and the clinical phases of a program when students may be separated by geographical distance. Teachers also can use distance learning strategies when students are unable to meet in real time because of scheduling conflicts, such as clinical commitments. An example is the use of an asynchronous discussion board to conduct an online journal club, in which students read an assigned journal article and use the collaborative learning process to solve instructor-driven problems that facilitate student higher order thinking. Other examples of distance learning activities include wikis, problem solving, and collaborative learning work groups.

Course designs need to focus on distance learning activities that facilitate student learning. The type of facilitation strategy used on discussion boards affects the development of cognitive presence in the COI model. Statistically significant differences were found between type of facilitation strategy used and phase of inquiry reached. Among the strategies tested, the debate strategy produced a greater number of discussion segments for the exploration and integration phases, but no differences at the resolution phase. Limitations to reaching the resolution phase may be overcome by incorporating specific student learning activities that are guided by the derived COI model.

The options for distance learning strategies are just beginning to be realized. As new strategies emerge, it is imperative that teachers are knowledgeable of the collaborative learning process and the components required for quality distance learning. Objective measures of student’s higher order thinking are essential to study emerging distance learning strategies. The derived COI model incorporates an objective measure of a student’s higher order thinking. The derived COI model incorporates all the essential components needed to design, guide, evaluate, and research distance learning activities and is ready for use in distance learning in nurse anesthesia education.

REFERENCES


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