An Online Community of Inquiry for Reflective Practice in an Operative Dentistry Course

Karen Gardner, D.M.D., M.Ed.

Abstract: Online learning communities are entering the realm of web-based learning as a means of reflective collaborative learning. The purpose of this article is to describe the formation of an online learning community using a community of inquiry (COI) conceptual framework. Operative clinical simulation dental students at the University of British Columbia in Canada have been involved in an online COI for the past five years. This descriptive article presents an overview of the experiences involved in developing this COI and provides a conceptual framework for an online COI.

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With the emergence of Web 2.0 as a development of the World Wide Web that goes beyond reading content (such as ePortfolios) to active, online, real-time participation to produce content,1 online communities have developed as another form of “space” people can share to form communities. Facebook uses Web 2.0 technology to establish a community or social network through the posting of messages on virtual walls that engage people in dialogue. Twitter engages people in community through instant messaging known as “tweets.” Researchers investigating these new forms of community have established that online communities are prevalent in students’ lives, with studies of college students reporting as high as 94 percent of respondents using Facebook.2,3 Facebook and Twitter are considered communities because they convey a sense of trust, respect, or relationship.4

This article describes a program at the University of British Columbia (UBC) in Canada that makes use of an online community for educational purposes by adding a learning component. Relying heavily on reflection, the educational methodology known as a community of inquiry (COI) aims to engage students through instructional design and facilitation encouraging participation in dialogue with other students. In so doing, students derive meaning from their work and establish social connections resulting in community or a sense of belonging.1 The goal of the UBC online COI was to help third-year operative dentistry students develop some of the diagnostic and communication skills required in practicing dentistry. These skills include use of digital photography, participation in professional online communication, use of technology, and the abilities to build relationships and to gather and analyze information. Learning these skills assists students in forming a basis for future online continuing education,5 the globalization of dental education,6 and improved reflection.7 The COI’s learning objectives were in the areas of communication, accountability, teamwork, evidence-based practice, and feedback and reflection (Table 1).

This descriptive article introduces the online COI developed in an operative dentistry preclinical psychomotor surgical skills training module at UBC. An overview of the online COI will be presented, along with examples of students’ work to provide a conceptual framework for an online COI. The learning objectives will be described, and the students’ work and feedback will be presented to illustrate the progress made to date. Over the past five years, 132 students have participated in the COI. All data for this report were collected in direct quotations from the students’ COI dialogues and their reflective assignments.

COI Framework in an Online Format

The UBC COI framework is based on a collaborative constructivist approach. This perspective considers the educational experience to be a collab-
orative process that uses communication to construct meaning and knowledge through interaction with one’s environment, which in this case would be the COI. Guidelines for faculty members’ creation of an online constructivist’s format include the following: make the assignment relevant; facilitate reflection; make part of the assignment collaborative; include an individual portion in the assignment; and facilitate rather than lecture. This approach recognizes learners as central to the process by actively engaging with and analyzing the information through questioning to provoke their thought processes.

To address this aspect of engagement, UBC students are encouraged to present their questions to other students in the COI in an evidence-based format. Three of the students described this type of engagement as follows: “we are taught to place the retainer at least one tooth posterior to that being restored for a posterior restoration, to expose all teeth up to the central or lateral [citation]”; “the literature states that pre-wedging is generally not needed for [a] Class III restoration”; and “you explained all the critical requirements very well, backing them up with evidence and references.” The evidence-based portion of the grade is included in the professionalism component (Table 2).

COIs are organized learning exchanges that consist of educators and students who participate in learning through the interaction of cognitive, teaching, and social presences. The COI at UBC thus consists of a cognitive presence, a teaching presence, and a social presence (Figures 1 and 2).

### Cognitive Presence

The cognitive presence refers to elements that encourage development of critical thinking and use less interaction to allow private reflection, a necessity for high-quality adult online learning. This learning is assessed through the students’ use of an evidence-based approach in their dialogues, critical analysis of the information presented by other students, and student-to-student constructive feedback in developing strategies to achieve the assignment’s learning outcomes. The premise is that a student will post his or her assignment, and the other COI members research the literature presenting solutions, resulting in a collaborative approach to what the learning community considers the best solution.

Cognitive presence produces learning outcomes beginning with the initial contemplation through the rationalization to the confirmation of a final learning outcome. In the module, one student established a cognitive process by initially stating (in text-based format): “During this exercise I learned the art of [preparing teeth] in multiple planes to create a contoured or flat surface.” The same student then provided the following rationalization: “As hand

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**Table 1. Learning objectives of the University of British Columbia operative dentistry community of inquiry assignment**

<table>
<thead>
<tr>
<th>Area</th>
<th>Learning Objectives</th>
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<tbody>
<tr>
<td>Communication</td>
<td>• shows interest, engages</td>
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<tr>
<td></td>
<td>• summarizes points</td>
</tr>
<tr>
<td></td>
<td>• corrects misinformation</td>
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<tr>
<td></td>
<td>• uses digital photographs that present their work well (not blurry and represent the topic of the discussion)</td>
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<tr>
<td></td>
<td>• understands the technical aspects of the web-platform</td>
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<tr>
<td>Accountability</td>
<td>• is respectful: answers within 2 days</td>
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<tr>
<td></td>
<td>• answers all questions presented by the learning community</td>
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<tr>
<td>Teamwork</td>
<td>• respects self and others</td>
</tr>
<tr>
<td></td>
<td>• is supportive and encouraging; is not dismissive in replies</td>
</tr>
<tr>
<td></td>
<td>• does not hinder the learning experience</td>
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<tr>
<td>Evidence-Based Practice</td>
<td>• extracts information from different sources</td>
</tr>
<tr>
<td></td>
<td>• always and appropriately cites sources of information</td>
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<tr>
<td></td>
<td>• critically evaluates any conflicting information by presenting one’s own reasoning</td>
</tr>
<tr>
<td></td>
<td>• challenges information</td>
</tr>
<tr>
<td></td>
<td>• presents full reference when needed</td>
</tr>
<tr>
<td>Feedback and Reflection</td>
<td>• provides kind constructive feedback to others</td>
</tr>
<tr>
<td></td>
<td>• accepts and acts on reasonable feedback</td>
</tr>
<tr>
<td></td>
<td>• proposes strategies to achieve goals</td>
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skills have progressed and preparations become more complex, it has required considering contours of the tooth in multiple dimensions at any one [preparation] point, and thus hand movements have to be more fluid and in multiple planes and dimensions between passes of the bur to create anatomy or planes that are smooth across a whole surface.” In this example, a more complete answer would include references to support the conclusions. However, this learning outcome demonstrates an inner awareness of what is required in the psychomotor domain to achieve this artistic result. This student did include a reference from an aesthetic journal in the reference list and phrased the final learning outcome as follows: “I feel that visualizing multiple dimensions in my preparations as opposed to mechanical movements in one direction was the real breakthrough with this one.” Thus, the student began the cognitive process by considering the concept of preparing teeth in multiple planes and then rationalized that a more complex preparation will have multiple planes at every point, which is why this preparation was not taught at the beginning of the module. The student stated the important learning outcome of the cognitive presence as follows: “the key is visualizing multiple dimensions as opposed to mechanical movement.”

The cognitive presence becomes apparent in the dialogue as students sort out various approaches to similar problems. For example, students debated about retentive features in posterior preparation design. Quotations from three students illustrate this process: “argument for lack of retention grooves makes sense and seems to be well supported within your text. I do agree there are various ways to do dentistry, this being one of them”; “you explained all the critical requirements very well, backing them up with evidence and references”; and “the preparation looks good and your argument of it having resistance to displacement and conservation of the enamel makes sense.”

Social Presence

Social presence or the feeling of existing in the presence of another in the COI consists of elements of emotional expression, open communication, and group cohesion. Emotional expression in an online COI can be challenging but is a necessary factor that is considered a critical design component to achieve cognitive presence. Examples of emotion expressions are emoticons (smiley faces), conveying a sense of humor by saying “that’s a joke,” or self-disclosure. For example, in face-to-face communication we see facial expressions and experience the other’s mood: if one smiles or laughs, we interpret this as happiness. In a text-based environment, social presence in the physical sense is absent, and some students find that difficult. Open communication can be achieved by students presenting a question to the community and asking for input and thoughts, posting a self-representative photo, or telling the group about their home city. Homepages hosting group photos of the students are another form of open communication. Often participants need to learn how to establish this presence or be reminded that this is a component of the COI. In the cognitive presence example, the student established social presence in several ways. Initially, a photo of the student was uploaded to the student’s homepage, allowing other participants in the COI to put a face to the name. Next, the student would speak in the first person to
establish a more informal atmosphere, and the student expressed emotions: for example, “I struggled with this restoration” and “Once I started using the burs to create tooth anatomy I had made it past the curve in the road.”

Another example of social presence is when one student in the COI commented on another student’s work, saying: “nice work, I particularly loved the blue arrows! :) and the final result looks awesome, I loved your complex amalgam today too. Your hand skills are pretty good.” As before, the student communicated in the first person, expressed emotion (“I loved”), and included a smiley face to indicate expression. Other quotes illustrating social presence were “I was just curious to check it out 😊” and “sorry I can’t be more useful.”

The result of social presence is a dialogue that builds community and a collaborative approach to the assignment and open communication. The following comments illustrate the community closeness reaching a new level: “Thanks again for sharing your excellent presentation. I look forward to your response” and “There were some problems encountered when I was doing a Class II amalgam prep; wondering if you had similar problems and how you solved them.” An emerging theme from the dialogue thus far is expressions of a newfound closeness among members of the online COI, as in these examples: “perceived closeness since time and space aren’t really felt”; “being part of an online community breaks down cultural differences”; “we are friends”; and “I am honored to be a part of your [COI] reflections.” The following is a positive comment about the online COI experience, anticipating this mode of learning will be with the students for their professional lives: “To be completely honest, when I was first introduced to the site I was a bit skeptical about it, but now that I’ve had the chance to think about it more, I am certainly more interested in following through with

![Diagram](image)

**Figure 1. Three essential elements of a community of inquiry**

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<table>
<thead>
<tr>
<th>Teaching Presence</th>
<th>Cognitive Presence</th>
<th>Social Presence</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Instructional design:</strong> organizing the community, determining the community “space,” community content</td>
<td><strong>Building understanding:</strong> establishing relevance, open dialogue with students and faculty involved, faculty workshops, research participants’ reflections, outcomes</td>
<td><strong>Emotional expression:</strong> emoticons, humor, self-disclosure</td>
</tr>
<tr>
<td><strong>Direct instruction:</strong> working assignment, marking rubric, facilitation throughout the assignment</td>
<td><strong>More critical thinking:</strong> use of evidence-based approach allowing a collaborative approach</td>
<td><strong>Open communication:</strong> mutual awareness, recognition of others’ accomplishments</td>
</tr>
<tr>
<td><strong>Less interaction:</strong> student reflection on the issues arising in the community, students begin as lurkers to observe the learning exchange prior to participating</td>
<td><strong>Group cohesion:</strong> breaking down cultural differences, a feeling of closeness</td>
<td></td>
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![Diagram](image)

**Figure 2. Components within the community of inquiry elements**
the site since I can see how it would help me in my professional and clinical development.”

Comments such as this are the basis to begin dialogue between the faculty and the students. Teaching presence includes instructional design, building understanding, and direct instruction with teaching by facilitation, which includes seeding ideas for additional research or presenting questions to move the inquiry along or to keep the inquiry on track (Table 3). The instructional design consists of an assignment describing the COI design (for example, the website with accompanying directions for use), how communities will be set up, and what the students’ responsibilities will be for participation. As well, the goals of the project are defined (Table 1), and a rubric is established (Table 2). Building understanding occurs at the student and faculty levels. For faculty, annual workshops are held to provide technology user training, discuss constructivism implementation, and review issues that have arisen over the past year. Building understanding into the process is crucial because this will be quite different and challenging to approximately 20 percent of the students and possibly more of the faculty members.17-19

As with other forms of online learning such as Second Life,20 success of the COI is heavily dependent on good technical training for the faculty as well as the students. At the beginning of the school year, an hour is set aside in our computer lab for faculty and student training. This involves a hands-on guided tour through the web platform with a sample exercise allowing both faculty members and students to become comfortable with the technology, software, and the assignment. In addition, instructions are sent via e-mail to all participants with print screenshots to give visual as well as written instructions (Figure 3). Students and faculty members are able to contact me or the technology support team for assistance via e-mail whenever they have a problem. Also, students are advised to help each other in the COI as part of their collaboration and group cohesion,21,22 and faculty members are coached on an individual basis during the clinical exercises to sort out any problems they may have. Usual problems that are encountered include forgetting passwords and trying to upload photos with a high resolution.

Commonly, students who have not participated in an online course before find the asynchronous aspect of communication challenging, frequently asking the facilitators why they have not heard from their COI colleagues. Teaching presence involves discussing possible reasons for asynchronicity such as allowing students to realize others in the COI have busy schedules as well or perhaps there is a technical issue that requires attention. The facilitation may also involve communicating with students if they are taking too long to respond. The following comments illustrate this student frustration: “I have my presentation posted and there are no comments”; “It was somewhat difficult waiting for the other students to send me their presentation and responses at times”; and “The other party was not involved and did not answer some questions or talk to the professor as I asked.”

### Teaching Presence

COIs are new to most faculty members, so pedagogical training in facilitation and online learning is provided to all those who participate in the module. Facilitation is provided by the faculty members to participating students in the following ways: 1) in response to student queries, guiding questions are sent to the students to assist them in arriving at the answer; 2) questions are asked of the COI based on work students have submitted; and 3) formative feedback is provided prior to the summative mark. Occasionally, situations will arise during the dialogue requiring a personal e-mail. Examples include the following types of responses: 1) rewarding—the student may be very effective at defending his or her position on a particular issue and the faculty member would complement them; 2) challenging—a student may not be responding to questions presented by other members of the community at which time the student would be encouraged to become more accountable;

<table>
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<tr>
<th>Objective</th>
<th>Consider</th>
<th>Need-to-Know</th>
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<tbody>
<tr>
<td>What are our critical requirements for this procedure?</td>
<td>Why do we consider these requirements critical?</td>
<td>Are the critical requirements supported in the literature?</td>
</tr>
<tr>
<td>Do these requirements differ from those of your peer, or are they the same?</td>
<td>If differences exist, how does your peer’s situation influence these differences? (for example, societal values)</td>
<td>Are the differences supported in the literature?</td>
</tr>
</tbody>
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Table 3. Guiding questions of the University of British Columbia operative dentistry community of inquiry
and 3) challenging—a student may be dominating the learning process and not allowing others to participate whereby the student would be encouraged to allow others equal participation. Some web platforms develop a “cafe” where students can participate in dialogue outside of the assignment to allow an open form of communication separate from assessment.

Software and Web Platform Development

Originally, the project was hosted as a blog using Elgg software (Figure 4). This software allows the formation of learning communities and the uploading of files into folders that can have a privacy setting of restricted, logged-in user, or public. The COI was designated restricted with admission granted only to the members of the COI. The Elgg software worked well for the initial running of the COI, but its appearance is quite institutional and Elgg was purchased by Educause, making upgrades out of our reach. In addition, students requested a more contemporary software similar to Facebook and other sites with which they are familiar.

After two years, funding was received to design and build a web platform, which is the present website for our operative COI (www.diastemas.net) (Figure 5). The differences between this web platform and Facebook are that this platform has complete control over privacy settings, areas for community building and private spaces, the requirement that students must be attending a participat-
Figure 4. Original site for the online community using Elgg software

Figure 5. Web platform used for the online community of inquiry
ing school to apply for admittance, and a space to be shared between each student and the module coordinator for uploading of marked assignments (Figures 6 and 7).

Another major advantage to having our own web platform is that we are able to make upgrades as we become more advanced in our COI. Upgrades to date include e-mail notification when bloggings are posted to the COI, students belonging to the COI can still have private postings between themselves and their instructors (eliminating e-mails), and the COI is set up apart from the students’ space, allowing

Figure 6. Folders containing COI members’ files

Figure 7. Students’ space on www.diastemas.net with private space for graded assignments
them to access other students’ work that is not part of the COI.

Discussion and Conclusions

Online communication is here to stay, and my observation is that each new group of dental students requires less technical coaching to participate in the online COI. This trend could indicate increased student technical awareness in online communication. Future work will investigate this area. It is imagined because of this ubiquitous approach to communication, professional lifelong learning, collaborative courses between dental schools, and eventual globalization of dental education if not already here will not be far away. This technology is moving fast, and dental educators should benefit from embracing the changes and work with them to keep the dental education learner centered within a digital format. Online COIs as well as reflective blogging and Second Life are some of the formats educators are currently working with to develop guidelines for effective student-centered learning.

Challenges in implementing a COI include training faculty members and students to be comfortable with the technology, being comfortable with asynchronous communication, and being comfortable with social presence in a digital format. Research investigating these challenges is starting to provide answers. For example, in the case of social presence, there are many variables that require attention to make the online experience satisfying for the learner and thus leading to increased learning. Social presence challenges include length of response time (a faster response to questions from others in the group increases social presence), quality of the response (taking time to research the answer resulting in knowledge-building discourse), level of participation (answer others’ questions and generating more questions to build discourse), experience with online media and information and communication technology, and affective feedback (addressing the person by name, being complimentary, and being patient). With respect to training faculty members and students to be comfortable with technology, research has found that at any given time 20 percent of the population including millennials will be challenged by technology and that training is required for both students and faculty members to ensure a smoother process. In addition, working in an asynchronous environment is foreign to students who have not studied in this format, requiring facilitation and coaching by faculty members to help students become comfortable with a lag time in response. However, courses should be designed to minimize the response time and prevent other forms of non-participation by students. Designing these methods of instruction referencing a conceptual framework such as text-based critical inquiry is one way of possibly avoiding the challenges and enhancing the student experience. In the future, instructions will also be formatted in a podcast and placed on the module website.

Other dental schools are urged to contribute to this momentum by continuing to develop new areas of digital technology to help all of us move toward educationally sound and effective online methods of learning. My subsequent work will assess the effectiveness of the COI in the operative module, paying close attention to learning experiences and outcomes. Future investigations should continue searching for emerging themes in the participating student dialogue and surveys and measure student outcomes.

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