Investigating Deep and Surface Learning in Online Collaboration

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Abstract: This paper examines a cross institutional online collaborative project where pre-service teachers in Canada and Australia explored issues of diversity, inclusion and ICT integration through online discussion and videoconferencing. The project enabled students to engage in authentic dialogue with other pre-service teachers in different courses and different counties. They were joined by academics, teachers and others with expertise in the areas described above to continue to question, share experiences, make links to theories, extend their knowledge, and investigate issues of pedagogical practice. The data were from online discussions, reflective artefacts and focus group discussions. Online discussions were analysed using Henri's (1992) content analysis model to investigate the depth of the pre-service teachers' postings.

Introduction

Disconnect: 2007 Reflective Journal Entry

Here I am in week five of my teaching practicum and I'm frustrated. I have been observing how technology is used in my classroom. I can't put my finger on the problem but there seems to be disconnect between what happens in my life with technology and what happens in my classroom. For example, I am constantly connecting with friends through text-messaging on my cell phone or through FaceBook, I pay the bills through online banking, bought my new antique lamp on eBay and I spend far too many hours playing computer games. At the university, we had some experience with technology and were introduced to such items as WebQuests and databases and had the experience of being part of an online international collaborative project where we used discussion forums and participated in videoconference. But what I observe in this school does not even come close to what my friends and I do with technology in our personal lives. It seems that digital technology in school is used to word process assignments, creating MS PowerPoint as a product rather than using it as a presentation tool and when students do research it seems to be all about what can be Googled. Is this the norm? How does this impact learning? I need to get my head wrapped around the notion of integration of technology in school. Why it is not more ubiquitous and more like how I use it in my life outside of school?

We live in a world where access, mobility and digital networks are the norm. Cell phones, computers, and wireless networks are in our homes and workplaces. Many pre-service teachers are digital natives (Prensky, 2001) and are comfortable with and are avid users of information and communication technology (ICT) in their personal lives. However, the ubiquitous nature of ICT in today's world is not necessarily a commonplace in today's classrooms.

Googling, gaming and text-messaging may be part of pre-service teachers' personal lives and they may have advanced skills in using these applications. However, these activities do not necessarily equate to effective use of ICT in supporting student learning. These individuals may be comfortable and competent in using digital technologies and applications but they may not have an understanding of how to use them *for* learning and to support deep learning. There may be a breadth of technology knowledge, but they may have no depth in how to use the technologies to support pedagogical goals.

To move the use of ICTs in classrooms from being cute (e.g., something new or different) to being convenient (e.g., increase productivity) to being complementary (e.g., additional) to core (e.g., integral and necessary to extend and enhance learning) requires a change in perspective in how teachers view technology use in their personal and professional lives. Within classrooms, we can no longer afford to view ICT as an option or a fun activity that is added to daily work. Rather, through the intentional design of the learning, ICTs should be an integral element of the work and extends learning beyond what can occur without computer-based technology. Clifford and Friesen (2001) argue that "technology allows students to do things at a level of complexity and sophistication impossible without a computer. It permits them to move with ease and confidence in real and virtual worlds where things change. It allows them to create, not simply consume and reproduce knowledge" (p. 38). Further, effective learning through technology requires students and teachers to use the technology in similar ways to how it is being used in the world outside classroom walls.

Standards are Set

Ministries of education through professional standards for teaching have provided explicit expectations for technology-enhanced learning experiences for students in K -12. For example, in Alberta, Canada, a Ministerial Order (#016/97) requires all Alberta teachers who hold Interim Professional Certificates to demonstrate they understand:

> j) the functions of traditional and electronic teaching/learning technologies. They know how to use technologies and how to engage students in using these technologies to present and deliver content, communicate effectively with others, find and secure information, research, word process, manage information and keep records (Alberta Education, 1997, p. 2).

In Queensland, Australia there are professional standards for teacher education programs and for teachers that require them to "use teaching, learning and assessment strategies and resources in which ICT is embedded" (Queensland College of Teachers, 2006, p.7).

Both Queensland and Alberta also have mandated curriculum documents that guide teachers to integrate ICTs across the curriculum within authentic learning experiences. Such documents encourage the use of ICT in learning "[a]ctivities, projects and problems that replicate real-life situations" (Alberta Learning, 2000-2003, p. 1).

Professional agencies such as International Society for Technology in Education (ISTE) have created the *National Educational Technology Standards for Students and Teachers* (2007) which identifies standards for ICT integration. These standards can provide a framework from which teachers can design learning with technology that fosters the development of 21st century skills.

Established standards and expectations provide a structure to guide educators in using technology to support student learning. Yet, what factors are required to push technology from being cute or convenient to becoming complementary and core within the K-12 classroom? What is the tipping point that changes how technology is used to support deep learning? What is needed to move the tipping point from surface learning to deep learning when technology integrated or infused in the learning environment?

Teacher Education

Faculties of education need to learn how to "leverage this new knowledge and skill set in fostering innovative, technology-based pedagogical practices within teacher education? How will pre-service teachers learn *how* to appropriately use the technology to foster meaningful, deep learning?" (Clifford, Friesen & Lock, 2004, p. 56). Davis and Tearle (1998) argued "that the training of teachers in ICT skills and appropriate pedagogical approaches is essential" (cited in Kirschner & Selinger, 2003, p. 8). As teacher educators, we need to find ways to integrate ICT in authentic and meaningful ways throughout teacher education programs. The following principles identified by the Society for Information Technology and Teacher Education (SITE) can be used to improve how teachers use technology in classrooms:

1. "Technology should be infused into the entire teacher education program."
2. "Technology should be introduced in context."
3. "Students should experience innovative technology-supported learning environments in their teacher education program" (Thompson, Bull & Willis, n.d.)

This paper reports on an online collaborative initiative within two teacher education programs that attempts to provide innovative learning experiences that maps on to the above third guideline. One of the goals of the initiative was to design and facilitate an online experience that fostered deep, meaningful learning for students.

Deep and Surface Learning

Gordon and Debus (2002) described surface learning as involving memorization and regurgitation of material where learners have difficulty in generating a range of alternative solutions in different contexts. This form of learning tends to occur when learning is in isolation, where knowledge and practice are not integrated and where students are learning by themselves, rather than being part of a learning community. Weigel (2002) would add that students would "treat the course as unrelated bits of knowledge", would "find difficulty in making sense of new ideas presented", and would "see little value or meaning in either courses or tasks" (p. 6).

In contrast, Henri (1992) argued that deep learning "is accomplished only when the learners translate newly-acquired information into their own terms, connecting it, for example, with their lived experience" (p. 130). Attributes of deep learning would include such items as the learner being able to "relate ideas to previous knowledge and experience", "check evidence and relate it to conclusions", and "examine logical and argument cautiously and critically" (Weigel, 2002, p. 6). Teaching for depth means bringing students into intimate contact with those deep things (Bereiter, 2006).

Scardamalia and Bereiter (2003) advocated that a shallow constructivist approach has students describing their learning and results in students demonstrating "little awareness of the underlying principles that these tasks are to convey" (p. 1371). Whereas, a deep constructivist approach involves "…practices such as identifying problems of understanding, establishing and refining goals based on progress, gathering information, theorizing, designing experiments, answering questions and improving theories, building models, monitoring and evaluating progress, and reporting are all directed by the participants themselves" (Scardamalia & Bereiter, 2003, p.1371).

To achieve deep understanding, requires educators to design and facilitate learning experiences that have students engaging in problem solving, higher order thinking and collaboration. Collaboration within a learning community is the process of "sharing and generating new knowledge together with one's peers" (Slotte & Tynjälä, 2005, p. 193). Effective collaboration, according to Wiske, Franz and Breit (2005) "involves interactions with other people, reciprocal exchanges of support and ideas, joint work on the development of performances and products, and co-construction of understandings through comparing alternative ideas, interpretations, and representations" (p. 105).

As teacher educators, who want to create deep understandings through rich learning experiences supported through authentic integration of technology, careful attention needs to be given to the design and facilitation of the learning. Creating a space for deep learning using technology within teacher education, provides students the opportunity to experience what that looks and feels like. In addition, they have a model from which they can then design online learning that fosters deep learning when they become teachers in K-12 classrooms.

Research Design

A case study approach was used given the exploratory nature of this research. A qualitative research case study is defined as "the study of a 'bounded system' with the focus being either the case or an issue that is illustrated by the case or cases" (Creswell, 1998, p. 249). As noted by Merriam (1998), the "interest is in the process, rather than outcomes, in context rather than a specific variable, in discovery rather than confirmation" (p. 19).

The study was conducted February to April, 2007. It involved students from five classes within three different courses located in two different universities. The students (and teacher educators) participated in a collaborative online project to explore diversity, inclusion and ICT integration within K – 12 classrooms. The classes came from pre-service education programs at the University of Southern Queensland, Australia and the University of Calgary, Canada. Participation in the project was part of the formal assessment in all three courses; however participation in the research was voluntary. Fifty-seven students consented to participate in the research study. The following questions framed the research:
- In what ways can international online collaboration promote deep inquiry?
- How can online collaboration promote inquiry into teaching within diverse contexts?

Although all students were in face-to-face courses, the work for this project occurred online using Blackboard™, a learning management system, and with videoconferencing. The project consisted of the following three phases, with phases two and three being the focus of this paper:

1. **Introduction and Book Rap:** Online discussions and videoconferencing were used to set the scene; share expectations for the project, postings and assessment; build community (e.g., introductions as a way to get acquainted and building trust); and a shared experience to trigger ongoing learning. The shared experience was for students to read one of three selected novels and within novel groups share their reviews of the books within an online discussion forum among their peers from both universities.
2. **Online Discussions with Pre-service Teachers and Experts:** Online discussion forums explored inquiry questions where prior experiences and knowledge of self and others; shared resources and related literature assisted in co-construction of possible solutions. In addition pre-service teachers entered into dialogue with teacher educators, colleagues and experts within the areas of ICT integration, diversity and special education.
3. **Exploration of Pedagogical Practice and Classroom Applications:** Online discussion and videoconferencing was used to support students in making links between experience, knowledge, literature and classroom practice; identifying and planning for personal and professional growth; and reflecting on the project processes and their learning within the project.

Data Analysis

Transcripts from the online discussions were analysed using Henri's (1992) content analysis model for asynchronous computer-mediated communication. His framework was developed to assist with the investigation of both the product and process of learning within computer mediated conferencing. The framework consists of the following five dimensions accompanied by indicators:

- **Participative:** quantifies participation rates by identifying the total number of messages;
- **Social:** socialializing, community building and non content specific postings;
- **Interactive:** postings connected to or responding to other postings in an attempt to move the discussion forward;
- **Cognitive:** postings where participants clarify, formulate inferences, make judgements or propose strategies;
- **Metacognitive:** participants identify knowledge of self, task and strategies for completion in addition to skills in evaluation, planning, regulation and self-awareness.

The cognitive dimension can be broken into two methods of processing information: surface processing and in-depth processing. The following are sample indicators of surface processing: duplicates previous information without putting forward inferences; supporting the opinions of others without expanding on the ideas; critiquing with no substantiation; asking irrelevant questions; presenting multiple solutions without prioritising; and disjointed postings (Henri, 1992). In contrast, for in-depth processing, it involves integrating information from different sources to make suggestions, conclusions and evaluations; suggesting multiple solutions with recommendations; offering strengths and weaknesses of proposals; putting forward evidence or examples; assessing recommendations; focusing on the big picture; and evaluating solutions within the broader perspective (Henri, 1992).

Themes were identified from the focus group interviews and artefact data sources. Responses were analysed to identify common themes and areas of conflict which were mapped against the indicators from Henri's (1992) framework and the research questions.

Findings and Discussion

Data were collected from the archives of online discussion, student reflective artefacts and focus group discussions. To protect the identity of pre-service teacher participants, pseudonyms have been used when quoting their statements.
As part of the second phase of the project, students engaged in inquiry questions that were developed by their peers with some modification by the instructors. The inquiry questions were associated with the inclusion and diversity concepts explored within the novels. Student participation in this forum included sharing of their past experiences and learning, contributing relevant literature, in addition to linking their experiences and questions to the experiences of others and the literature.

Table 1 reveals that the average number of postings per student was 6.22, with the majority of the postings being coded as interactive and cognitive. The cognitive element was further deconstructed as being either surface processing or deep processing. Surface postings occurred 3 times more frequently than deep processing. This aligns with Henri's (1989) earlier work where he found that most students were participating at a surface level. Gunawardena, Lowe, and Anderson's (1997) and Pawan, Paulus, Yaalcin and Chang's (2003) analysis of interactions also found that "students engage primarily in sharing their thoughts and exchanging information rather than challenging and questioning each others points of view" (p. 127).

	Participative	Social	Interactive	Cognitive	Meta-cognitive	Surface processing	Deep Processing
Number of Postings (n=57)	355	1	215	131	3	107	28

Table 1: Frequency of Pre-service Teachers Online Responses within the Novel Inquiry Forum

While students interacted with each other it was often a one off post rather than to engage in a continuous cycle of post/response/post/response which could challenge, explain or extend their thoughts and the thoughts of others. Although John and some of his colleagues remarked that "because of the lack of basic knowledge of the topics it required a lot of extra reading time. Actually a lot of research was required to participate in any forum". This indicates that various students were taking the time and effort to integrate information/ideas from other sources and to substantiate comments.

These results seem to conflict with many other studies (e.g., Brook and Oliver, 2004; Garrison and Anderson, 2003; Heckman and Annabi, 2005; Meyer, 2003) which advocated that online learning environments afford opportunities for reflection, higher order thinking and deep learning. The notion of *if you build it, they will come* does not mean that they will engage at deep cognitive levels when they get there. The real quest is moving beyond opportunity to action.

The opportunity for different learning experiences however is what the students indicated as being a favorable aspect of the project. Jess suggested that the online environment gave all participations an "opportunity to say something, in face to face classes not everyone able to always contribute and the online discussion gave us additional time to participate". Alex remarked that "it was unique experience and although challenging, and sometimes frustrating, I have had opportunities to hear the view of many different people about inclusive education in a way that would not normally have been possible."

A second part of this phase was for the students to engage in online dialogue with experts. The experts were teachers, academics or consultants who had specialist knowledge and experience in the areas of: ICT integration, adaptive technology, diversity, inclusion, special needs, globalization of education, ESL, and autism. Billy and many of his peers observed that "the input from experts was very helpful". In contrast, Jack commented that "the expert forums were not helpful since the issues being discussed in some cases were not addressed by the experts". Jack appears to value the comments of experts beyond those of his peers and would have preferred all comments to be responded to by the experts. Interestingly Jane valued the experience of their peers: "I felt inadequate when discussing certain issues, but I learnt that personal experience counts as well and I gained invaluable insights from others" this was supported by June's comment that the "discussion was informative, and it was personally enriching to hear real-life experiences on particular issues". In addition Frank proposed that the activity "forces those in the discussion to consider ideas and beliefs beyond what they already hold".

Table 2 indicated that the average posting per student within the expert forum was 5.58. Given this forum was only open for 10 days; it was felt that student participation was high. Having said that, Garrison and Cleveland-Innes (2005) remind us that "[i]nteraction by itself does not presume that one is engaged in a process of inquiry" (p. 135). Again within this forum, surface postings outnumbered deep postings with the ratio being approximately 5:1.

	Participative	Social	Interactive	Cognitive	Meta-cognitive	Surface processing	Deep Processing
Number of Postings (n= 57)	318	7	212	97	2	83	16

Table 2: Frequency of Pre-service Teachers' Online Responses within Experts' Forums

Sam felt that "it was an innovative way to deepen my understanding as a student on the topics of diversity, special needs mainly autism, humanity, and inclusive practices". Bill suggested that the online environment did lead to "deep discussion as I was free to have a say, we could hide behind computers". Kate reflected that she was disappointed when she "received no answer straight away" however she suggested that the "additional time allowed for reflection and gathering of resources to substantiate comments."

This conflict between the students' perceptions of deep learning and the researchers coding of the data might have occurred because of the different approaches to learning within the cohort. Biggs (1993) and Ramsden (1988) suggested that surface learners are motivated by fear of failure and complete tasks with minimal effort. This approach is when the learners find the learning activity or assessment task an imposition rather than an opportunity to learn. In contrast, deep learning students have an emphasis on being the best they can be and approach the assessment and tasks with learning being the central purpose. Learners can move between the two different approaches and perhaps for some of the students other elements of their academic, working or personal life took priority during the project or parts of the project.

Interestingly within their reflective writing and the focus group discussions, students highlighted their perceptions of deep and surface learning within the project:
- "Late postings and lack of substantive conversation was an issue"
- "There seemed to be lots of surface postings, where some people were posting just for the sake of posting rather than think deeply prior to posting"
- "I felt it was creditable information when student shared experiences plus links to literature/research".

Although the researchers, who were also the teacher educators, were disappointed with the level of deep thinking made visible in the discussion forums, overall the learning experience received a very positive response from the students. Kath and others "found the project a positive and valuable learning experience and would like to see increased virtual access to others in other courses". Mark concurred by expressing: "What an incredible forum for us to gain new perspective and again and again we hear that you get out of situations what you put into them." Other positive aspects identified by the students was that it was authentic assessment which "hardly felt like an assignment at all".

The students have indicated that their participation in the project has had an impact on their future teaching with comments such as:
- "…this was a capacity building activity; I can use the information in other courses and in my own teaching."
- "This project was the stimulus for an in class project in my prac school."

The significant and assessable use of the online environment within their face-to-face courses was a new experience for many students and was sometimes challenging. Although recognising the frustration Betty summed up the learning outcomes for herself thus:

"As this type of online communication does not require members to be all online at the same time to share comments, a major advantage is that anyone with access is able to post comments and communicate with one another at anytime. This allows students from all over the globe to develop 'cultural awareness [*sic*] amongst pupils through collaborative, curricular work using ICT' (Abbott, Austin, Mulkeen & Metcalfe, 2004) whilst discussing and sharing their comments and opinions at a time convenient to all participants. A second advantage was the model and involvement in establishing and supporting a collaborative learning community."

Conclusion

Learning: 2017 Reflective Journal Entry

The Dean of Education on my first day asked each of us to think about the type of teacher we wanted to become. I began to think about who I am and what I bring to the field of education and to teaching. As a member of generation Z, my experience with digital technologies and applications, social networking, and global connections have shaped who I am and what I will do as a teacher. I see myself as a teacher not bound by bricks and mortar or limitations of technology which I heard my parents talk about when they were in school. The only factor bounding the learning environment created for my students will be my imagination. I have great ideas that will be manifested into fun lessons and exciting projects. I predict my students and I will have great adventures touring the world through online experiences, participating in virtual worlds, and engaging in conversation and problem solving with other learners from around the world as we sit in our local school community. But, I wonder, how will I get my students to understand the bigger issues and develop rich understandings from these experiences. How will I know if I have successfully created a learning environment where they have developed deep understandings?

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