

# Innovative Technology Integration within Teacher Education

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**Abstract:** One of the challenges in teacher education is to prepare pre-service teachers to think critically about pedagogically sound ways to integrate computer technology into curriculum. A further challenge that involves a greater degree of innovation, is to embed the use of technology within the Bachelor of Education program in a manner that can be a catalyst for developing teacher qualities including creativity, problem-solving collaboration and innovation. This paper will describe and assess the impact of three curricular innovations implemented with the pre-service teachers at Acadia: 1) a Virtual Learning Environment: *Managing to Teach*; 2) a student mentor program, and; 3) the use of electronic case studies around children with learning / literacy difficulties. Results of these initiatives have been encouraging, suggesting that problem-solving, collaboration, critical thinking and creativity are facilitated.

## Introduction Acadia University

Acadia University is a primarily undergraduate educational institution located in Wolfville, Nova Scotia, Canada. There are approximately 3800 students and 230 faculty members. Acadia has gained significant recognition with its campus-wide initiative, "The Acadia Advantage". The Acadia Advantage distinguishes Acadia from other Canadian universities, as the only fully-wired campus in Canada. The initiative was introduced in 1996 and has gained national and international recognition for its innovative approaches to post-secondary education. Since 2000, all undergraduate students and faculty use notebook computers for learning and teaching on a daily basis.

Today, upon admission to an undergraduate program at Acadia, all full-time students receive an IBM notebook computer, equipped with a multitude of software already installed, to use throughout their school year. All campus classrooms include ergonomically designed chairs, acoustic absorption material, large screen data projectors, and power and data connections at students' seats. In addition, each classroom has an adjustable docking station, on which faculty plug their notebook computer so that it may be projected onto the large screen at the front of the classroom. Public accessible campus buildings such as the student union building, the library, and student residences are also wired for student and faculty convenience. In total, Acadia has 7000 data connections across its campus.

## School of Education

Acadia's School of Education offers a two-year Bachelor of Education (B. Ed.) program as well as Master in Education programs in Learning and Technology, Curriculum Studies, Leadership, Inclusive Education, and Counselling. This paper will focus on innovations in the Bachelor of Education program. Students enrolled in the B. Ed. program take a required course specifically devoted to the use of technology in education, yet in all courses there are opportunities for the infusion of computer technology. It is the view of the School of Education that in order to have a recognizably positive impact on public schooling and the education of future citizens, it is important to take responsibility for educating teachers about technology in a manner that promotes creativity, innovation, problem-solving, and collaboration. Therefore, rather than an IT applications-training approach to the B. Ed. program, the School aims to create a technology-enriched support structure for the integration of pedagogically sound ways of using technology across the curriculum. The context allows faculty to dovetail the goal to integrate

technology in their courses with the objective to have potential teachers consider the ways that computer technology may be used for educating children.

## **Innovative Technology Integration**

Technology has the potential to alter traditional conceptions of schooling, teaching, and learning. To meet the challenge that emerging technologies place before us, innovative practices can assist pre-service teachers to be prepared to create and seize opportunities to transform teaching and learning. As a part of the Acadia Advantage initiative, the School of Education has developed numerous departmental innovations with regard to technology integration. However in this paper, three specific projects will be highlighted: 1) the Virtual Learning Environment: *Managing to Teach* (Stephens, Follows & Harris 2002) used to give students opportunities to engage in problem solving in the area of classroom management; 2) the Student Mentor program facilitated through the Acadia Institute for Teaching and Technology in which Bachelor of Education students serve as mentors to faculty and practicing teachers, and; 3) the use of electronic case studies to enhance understanding and problem-solving of children with learning / literacy difficulties for the course *Teaching Language Arts to Children with Special Needs*.

### **Virtual Learning Environment: *Managing to Teach***

The *Managing to Teach* Virtual Learning Environment (VLE) modules include a series of decisions and consequences. Some of the decisions and consequences are complex in that the user makes a choice and is then brought to a situation that requires another decision based on the consequences of the first. The VLE simulates realistic classroom settings and requires users to assume the role of a middle school teacher at the grade seven level. This includes an actual teaching assignment, a schedule, and classroom teaching assignments and duties. The VLE offers students a variety of technologies – text, video, and computer-generated decision-making options – in a world-wide-web format that gives users the opportunity to experience in a virtual way the many complex facets of the teaching environment. It was anticipated that by engaging in solving problems, B. Ed. students would acquire knowledge and skills, safely experience a variety of situations, and learn from receiving just-in-time coaching. VLE users receive advice from a mentor, a guide, and a number of seasoned teachers. It was further predicted that the VLE would provide opportunities for student teachers to take risks by making decisions in the area of classroom management and to experience the consequences of their decisions in the safe environment of the virtual school.

### **Student Mentor Program**

The Acadia Institute for Teaching and Technology (AITT) facilitated the creation and implementation of a Student Mentor program for the B. Ed. Students. Murray (1991) defines facilitated mentoring as “a deliberate pairing of a more skilled or experienced person with a lesser skilled” or “experienced one, with the agreed upon goal of having the lesser skilled person grow and develop specific competencies” (p. xiv). Generally when the term “mentorship” is used in reference to teacher education, the student is not conceptualized as the mentor. However, in this case B. Ed. students have a unique experiential learning opportunity to become mentors to faculty and practicing teachers, which ultimately provides them with immense opportunities to problem-solve, collaborate and think creatively about the use of technology. Roth, Masciotra, and Boyd (1999) make important assertions that teaching “cannot be acquired through didactic methods, but have to be enacted in lived experience” and that teacher development “can therefore be viewed as a becoming-in-the-classroom” (p. 771). Given that the B.Ed. students have studied teaching and learning extensively in their programs and explored innovative uses of technology, they are in an excellent position to be pedagogical leaders on the AITT teams. In turn, being a student mentor creates an authentic learning experience in which the students have an opportunity to apply their understanding critically and creatively to solve real-life problems.

In the summer of 2002, the nature of the projects the mentors participated in ranged from globally based initiatives such as working with a team from North Valley in Lemberg, Saskatchewan with the goal of integrating technology skills with the Saskatchewan curriculum, a project with the School of Hope who created and compiled video presentations along with text to create a multimedia CD ROM for grade 10 English, to more specifically

focussed projects such as working with a team from heritage Park Secondary School in Mission, British Columbia to perform laboratory experiments and then, using their own customized template, publish students' reports to the web.

Further, the Student Mentor program provided opportunities to experience being part of a collaborative team to develop innovations to solve real pedagogical problems. Mentors developed learning objects for faculty at Acadia and for use in schools. Learning objects may be defined as "any digital resource that can be reused to support learning" or educational materials that are "designed and created in small chunks for the purpose of maximizing the number of learning situations in which the resource can be utilized" (Wiley 2002 ¶1). Bratina, Hayes, and Blumsack (2002) suggest that since it would be ludicrous for every teacher to create his or her own textbook, it is similarly not practicable for every teacher to develop all of the learning objects for each course. Once learning objects are created, their accessibility and flexibility may be increased once they are added to an electronic repository available to educators and students (Porter, Curry, Muirhead & Galan 2002). In addition to the benefits of increased accessibility, some learning objects may also be adapted by educators to better suit the learning context as well as the learners themselves. These characteristics enable learning objects to offer an efficient way to support instruction in a variety of learning environments. In the past year, students developed learning objects ranging from an interactive animation on the basic components of an electronic circuit (an interactive tutorial using Flash and Excel on the theories and formulas for Pascal's Law, Boyle's Law and Charles' Law) to a visual tutorial on the proper playing positions for musical instruments. The creation of learning objects provided pre-service teachers with hands-on, authentic learning experiences while they enhanced their technical skills and knowledge.

### **Embedding Technology Exploration in Electronic Case Studies**

Five case studies were created using Microsoft Front Page, which provided students with a website framework which was then copied onto a CD for unlimited student access. Such a format enabled students to pursue a variety of relevant links to additional information, which may support and extend their understanding of each case study. The case studies were developed around students of different ages who were experiencing diverse levels of difficulty with literacy development. Various activities and explorations were embedded within the composition of the case studies.

One of the ways that technology was embedded in the case studies involved having work collaboratively in electronic groups to create online cognitive maps using Inspiration software. The groups used the strategy of brainstorming to ignite the flow of ideas with regard to how various literacy difficulties may impact the learning across the curriculum for the students of focus within each of the cases. Inspiration is a type of concept mapping software that allows students to represent relationships between concepts and information according to their current understanding and knowledge. The software enables users to graphically illustrate their knowledge by linking and organizing the information in an order which best represents these relationships. The creation of cognitive maps fosters critical thinking and encourages students to use higher-order thinking skills such as analysis, evaluation, and synthesis of information (Robertson 2000) and can facilitate structural knowledge (Jonassen 1996). According to Dabbagh (2001) conceptual mapping helps learners integrate and interrelate through the construction of a semantic network that communicates knowledge in a meaningful way. Once the cognitive maps were completed, they were used to support further understanding of how certain literacy difficulties may affect cross-curricular learning. The maps were also used as a basis for questions and discussion within the class, which often resulted in motivation for further investigation of concepts. Further, the students were also able to revisit and revise their maps based on their deepened understandings of literacy difficulties addressed within the cases.

One of the challenges in using the vast array of electronic resources in teaching at any level is to create a framework for student inquiry. WebQuests represent a method of inquiry based on a constructivist approach to learning, to direct learners to desirable, current information which is of relevance to the topic or issue of focus. Further, WebQuests "are designed to use learners' time well, to focus on using information rather than looking for it, and to support learners' thinking at the levels of analysis, synthesis and evaluation" (Dodge 2001 ¶2). Tom March (1998) claims that "when students are asked to understand, hypothesize or problem-solve an issue that confronts the real world, they face an authentic task, not something that only carries meaning in a school classroom" (¶8). Further, WebQuests use scaffolding or prompting which research has shown to facilitate more advanced thinking as students are engaged in higher level cognition (March 1998). A WebQuest inquiry was embedded in a case study. Students were provided with a workshop on creating WebQuests. Once comfortable with creating WebQuests, the B. Ed. students designed a WebQuest for a specific case that was attentive to unique needs and learning difficulties.

## **Results**

### **Virtual Learning Environment: *Managing to Teach***

After working through the VLE students completed an open-ended questionnaire. They were asked, “What benefits do virtual learning experiences have for students over more traditional types of instruction?” The feedback suggested that VLE provided the following: an opportunity for students to work at their own pace; a chance to spend as much, or as little time necessary to understand the material; real-life (hands-on) private instruction for students, which facilitated more critical thinking; a chance to observe actual student behavior and choices as well as their consequences; opportunities for students to gain experience; a safe environment in which students could make errors and reflect on them without risking backlash of students in the classroom if indeed an error was made in class; an alleviation of fears and concerns in advance and allows students to learn in a risk-free environment while obtaining a more realistic view of how students may respond in certain circumstances.

A second question to which students were asked to respond was, “To what extent was the VLE a meaningful learning experience for you?” Responses suggested that it re-emphasized the elements of teaching done by instructors but allowed for a more in-depth understanding; the VLE supported students to think about things that may occur in teaching; it modeled many of the situations students expect to encounter in their practicum; and the advisors and mentor were very helpful as they gave valuable ideas on classroom management techniques. In addition, it was thought that the VLE presented a few areas of classroom management that students had not previously considered. As one student stated, “the VLE was *essential* to my learning this term. It exposed me to many disruptive situations which will help me during my first practicum.” Feedback indicates that students are being challenged and motivated by an interesting, innovative, technologically-rich, interactive set of learning experiences that are consistent with the mission of Acadia University and the School of Education.

### **Student Mentor Program**

This initiative was assessed by interviewing students and examining the nature of the curriculum innovations created. Interviews with students suggested that one of the major advantages of being involved in the creation of learning objects and participating in the teams during teacher-training is that they had an opportunity to apply the technology to solve a real problem. Further, through the planning and creation phases they were encouraged to be mindful of the purpose of a learning object within the context of broader curricular goals. In the creation to the learning objects, as well as in facilitating the teams of teachers, administrators and students, the mentors worked as team members collaborating with others and gaining from others’ expertise. A further advantage was that use of the technology applications was purpose-driven rather than solely focused on skill development. During interviews, students repeatedly commented that they thought all B. Ed. students should have to participate in a similar mentor program because of the emphasis on linking theory to practice.

Planning sheets used in the creation of projects and learning objects supported students in thinking about the challenges they were facing in the curriculum and teaching solutions that might be attempted using the technology. They were encouraged to explore a number of applications and how they might be used to deal with the pedagogical problem. Further, the students reported that they were encouraged to think about how the strategy might be integrated into the curriculum and consequently evaluated. Whether the B. Ed. students were working with Acadia faculty, teacher-training teams, or learning objects to support their own teaching, they were asked to engage in the same thought processes. Students reported that this project’s framework supported and encouraged them to be mindful of technology’s purpose within the curriculum as well as the links between technology and pedagogy.

### **Electronic Case Studies: *Teaching Language Arts to Children with Special Needs***

After working through the five case studies the B. Ed. students evaluated the following components: a) WebQuests; b) Online Discussions; c) Inspiration Software; and d) Electronic Case Studies. Students completed surveys based on a 5-point Likert type scale (1 equals weakest; 5 equals strongest), which provided ratings in terms of how students perceived each element as a learning strategy for them as students, as a teaching strategy they would use, and as a collaborative thinking tool.

WebQuests and Electronic Case Studies were reported the most frequently as being a good learning strategy by 85% of the pre-service teachers ( $N=18$ ) while Inspiration software was found to be a good learning strategy by 72%. Inspiration software was the component which received the most frequent responses (78%) as being a tool they would use as a teaching strategy while 61% also considered electronic case studies to be a teaching strategy they would use. Electronic case studies were found to be the strongest collaborative thinking tool among 78% of students whereas Inspiration software was also reported as being a strong collaborative thinking tool by 67% of pre-service teachers.

## Concluding Comments

Research has shown that students have opportunities to spend additional time in active construction of knowledge when using technology (Bagley & Hunter 1992). Technology may also provide students with resources to which they may otherwise not have access for problem solving, thinking, and reflection (Dimock & Boethel 1999). Jonassen (1996) suggests that the interactive nature of technology and its information-processing capabilities in learning situations enable technologies to be used as “mindtools”, which he defines as “computer-based tools and learning environments that have been adapted or developed to function as intellectual partners with the learner in order to engage and facilitate critical thinking and higher-order learning” (p.9). Innovative uses of technology, such as those discussed within this paper, may serve an invaluable within teacher education whereas future teachers will be increasingly challenged to not only integrate technology in their classrooms, but to effectively implement technology in ways that enhance and extend the learning experiences of their students.

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