Technology Meets Pedagogy Acquiring a Vision of Why Using Technology Makes a Difference

Dr. Howard Slepkov
Chair
Department of Ontario Programs
Niagara University
Niagara Falls, NY, U. S. A. 14109

Abstract

21st Century classrooms require 21st century prepared teachers. Much research would suggest that, to date, new teachers are not adopting 21st century skills when they begin teaching and change in the integration of technology is too slow in coming. Many different models have been proposed to ensure new teachers are ready to integrate technological skills into teaching practice. However every indication is that this is not ensuring any kind of change. This article reviews many of the reasons for this and advances a new variable - an understanding of how the use of technology meets pedagogy for learning and how to integrate this learning into preservice programs alongside the usual foundations and methods courses. While helping candidates understand current teaching, cognition and learning theories, we must help them also understand how productivity and Web 2.0 tools match the ways in which digital natives must be taught and assessed.

Keywords: Education Reform, Elementary Teacher Education, Instructional Practices, Preservice Education, Technology

Introduction

Arne Duncan, the current U. S. Secretary of Education, suggested that "now is the time to revolutionalize the way students learn and the way teachers teach". (Duncan, 2011, p.10) His is not the first call for a more purposeful movement to integrate technology into the classrooms of the 21st century, both here and abroad. Collins and Halverson (2009) draw attention to the growing trend towards lifelong learning and how it is facilitated by educational technologies. They warn that if schools don't adapt to the use of these technologies, institutional learning will be left behind and unable to catch up. Rosen (2011) draws attention to the technological skills of today's students suggesting that their ability to use technology in general gives them opportunities previous generations of students did not possess. Nothing speaks louder to this transformative use than the role played by social networking tools in the waves of social and political change and unrest gripping many parts of the world. Hewitt (2005) presciently examined the unpinnings of the power of the Blogosphere as he explored for his readers the information revolution challenging old forms of mass communication. Kritt and Winegar (2007) look at the critical values and cognitive skills technology promotes in learning and Tapscott (2009) examines how the Net generation is changing the way we must think of learning. Under the leadership of this current Secretary of Education, the U. S. government has released a National Education Plan (2010) suggesting that schools in America need to use technology to engage and empower students, thereby capturing the essence of what these other researchers and many others have been saying for well over a decade and seeking to effect change in that direction.

Why A Call to Action?

While calls such as these for a greater role to be played by technology in classrooms of the 21st Century are appearing with increasing regularity in the literature, accompanying and often part of the same articles and books is a critical analysis of the lack of preparedness for this integration by the teachers in schools across the continent and beyond. Ertmer & Ottenbreit-Leftwich (2010) found that despite increases in computer access and technology training, teachers just aren't using the technology in ways that are the most powerful for learning. If one looks back into the literature, two decades ago Kerr (1991) wrote about the possible impact of technology use on classroom teaching practices and that was before the advent of the Internet and Java-enabled interactivity.

Corbett & Willms (2002) found that by the dawn of the new millennium more than 2/3's of all students in both Canada and the United States had access to computers at home but the use of the computer at school was dominated by word processing tasks. This would seem to imply that for the last two decades we have known that technology will enhance learning but haven't been able to master the skills or put in place the tools or sufficiently prepared educators necessary to make this happen.

I admit to being a pioneer when it comes to the use of technology as a tool in teaching and learning. I have been in that role for the better part of at least 25 years, first as a classroom teacher, then as a consultant for technology in the classroom and most recently as an assistant professor in a pre-service teacher education program. During the course of these past two and a half decades many reasons have been advanced to explain the lack of technology integration on a wider scale in classrooms but, while all of the obstacles suggested as barriers to such use by classroom teachers have been overcome, things have barely changed. I have asked myself the same question as others have posed. Why? What can possibly be standing it the way of maximizing the benefit of technology in the teaching by teachers and the learning by students in classrooms of the 21st Century? I have concluded, as have others, that a large part of the solution must begin with young teachers just entering the profession rather than the many experienced teachers already in the profession who are not digital natives.

The argument is made that pre-service programs must insist that technology play an increasingly prominent role in the preparation of new classroom teachers. (Ferriter,2010; Lambert & Gong,2010; Oberlander & Talbert-Johnson,2007). A variety of models to accomplish this have been designed, implemented, and tested for their efficacy. Among these are such strategies as the stand-alone technology course where there is little or no relationship between the tasks assigned and other program content (Bielefeldt, 2001) or the development oflearner–centred technology assignments which are part of other course work. (Rademacher, Tyler-Wood, Doclar & Pemberton, 2001). More recently, creating technology-rich instructional materials related to course content (Polly, Mimms, Shepherd & Inan, 2010) or the situated technology integration model (Hur, Cullen & Brush, 2010) have been suggested as increasing the likelihood that pre-service teacher candidates will attempt to use technology on their own when out in the field as part of their teaching practica. In the latter example, other research has shown that there is a strong connection between the technology skills and efficacy of the supervising or associate teacher and the chance that a student teacher will use technology (Brent, Brawner & Van Dyk, 2002).

Pedagogy First, Technology Second

So we return to the question of what is still standing in the way of technology integration especially by new teachers. Recent research has shown that although the Net generation is entering the teaching force with profound understanding of how to use Web2.0 tools for personal uses, they are at a loss as to how to apply these tools to classroom learning (Kumar & Vigil, 2011). Kumar and Vigil go on to posit the need to model the use of technology for 21st century classrooms and the need to expect pre-service candidates to create digital artefacts reflective of teaching and learning needs. It is the contention of this paper that just requiring candidates to use technology in authentic situations and to model the use of the technology in courses is not sufficient to ensure the transference of these skills to in-service practice. Rather, students need to acquire, for themselves, an understanding of how powerful technology in the classroom can be when used effectively (Heide & Henderson, 2001). The emphasis has to be on pedagogy first and not technology. If digital artefacts are created and students are given insight into the pedagogical reasons for such activities, then we might see greater integration follow (Cuban, 1986).

Ertmer & Ottenbreit-Leftwich (2010) speak to the intersection of knowledge, self-efficacy, pedagogical beliefs, and subject / school culture as being requisite if teacher change in the implementation of technology in the classroom is to occur. Previously, only three of these cornerstones have been assiduously cultivated in programs of teacher education. Knowledge of technology is a given in today's Net generation of young professionals (Tapscott, 2009). So too is self-efficacy (Kumar & Vigil, 2011). Subject and school culture relates to the use of technology once in the field as per the research of Brent, Brawner and Van Dyk (2002) cited above. These research findings would suggest that it is not at all a certainty that school cultural attitudes towards the use of technology is changing sufficiently quickly to guarantee its ongoing widespread implementation. It is the pedagogical understanding that is being suggested herein as the missing piece and a literature search suggested there is little being done on this dimension in current reported research.

Swain (2008, p.147) suggests that "there is a better chance of reaching true integration where technology is used to teach teacher education concepts and not merely the focus of the concept". This supposition can be found in and is supported by the work of Vannatta and Beyerback (2000) who saw successful technology integration flowing from providing individuals, whether they are pre-service instructors or candidates, with a constructivist vision of technology integration. There are many instances in the research that tend to support or even advance further this line of reasoning. Cheon, Song, Jones and Nam (2010) developed a conceptual model of the linkage from pre-service teachers' beliefs to their behavioral intentions and expectations regarding technology integration and then conducted research which validated their model. Nicaise and Barnes (1996), through their research, make a strong argument for providing in-service teachers with the opportunity to apply their learning about technology to practical opportunities to see the impact its use has on student learning. What applies for in-service teachers in their classrooms also applies to pre-service teachers as they prepare for those classrooms. This is the logical extension of the work of Kolb (1984) in that experience is the source of development. Micheller (2004) refers to this as building capacity for authentic learning.

The work reported on in this paper seeks to do just that, build capacity and provide an understanding of the necessity to use technology to maximize student learning and engagement. It further grounds its approach in the work of Bereiter and Scardamalia (1989) in that it uses intentional learning about the tools of technology as a goal of instruction so as to see not only how to but why integrate as well those tools in classroom teaching practices and, thereby, provide pre-service teachers with a vision of its utility, applicability and potential impact on the student. It is predicted that having such a vision will enhance the likelihood of using technology in practice-teaching situations and make more likely continued use of technology once out in the field.

Edublogs as Culminating Performance Tasks in Methods Courses

The work reported on in this paper derives from specific course assignments, completed classroom tasks and student-teacher communications about both of these as learning tools. This occurred as part of the teaching by the author of various courses in a pre-service program in Southern Ontario. The university where these courses were offered is a small private institution and the candidates graduate with certification as teachers in schools in Ontario. In each of thecoursesthat this researcher has taught, the emphasis from the beginning of any course to its end is the use of various technology tools in the accomplishment of pedagogically driven learning tasks and in the completion of assignments. So as to coalesce into a learning community, students post introductions to themselves accompanied by digital pictures on a specially designed Wiki page and they then share points of similarity with each other in discussions online. They write about early learning experiences in Language Arts, Mathematics or Science and then compare them to what they see happening in the classrooms they visit in discussion threads posted to Blackboard so that they may see that change occurs upon reflection and comparison. They create group PowerPoint presentations to advance solutions to school-based literacy problems in order to understand that sometimes classroom change is driven by school initiatives.

They use brainstorming software to collaborate on unit plans for integrated novel studies or science themes in order to understand how that same learning strategy can enhance the quality of problem solving within their classrooms in the future. They explore websites on a plethora of subjects and themes with the Smart Board all the while sharing with each other what might or might not engage students and why. They submit assignments electronically and receive feedback attached to their Word documents to see that assignments need not necessarily be in paper and ink or pencil. In each and every aspect of the courses taken from me, the focus might be on the essential fundamentals of teaching and learning but the tools used to deliver on these methods are technological. By extension, pedagogically students are exploring the power of technology to enhance teaching and learning. Accompanying any series of instructions are explanations not only of how the technology needs to be manipulated but how it fits pedagogically into the over-all learning goals of the program. Feedback and follow up to each assignment includes reflection on how the technology played a significant role in accomplishing their various learning tasks.

One of the major assignments for the students to complete and the **specific focus** (exemplar) of this paper is an EduBlog using free Web 2.0 tools but with the expectation that certain pre-defined criteria will be met. (See Appendix A & B) The criteria vary with the nature of the course it was part of – either a course on the Foundations of Literacy or Methods of Teaching Mathematics and Science or General Methods of Teaching but always in the primary / junior classroom.

As part of their course work, and throughout the duration of the sessions, students are introduced to the utility and pedagogy for using EduBlogs to help engage their future elementary students in their classwork, extend the learning into areas not covered in the classroom, provide information to the students and their parents about the work done to advance classroom learning goals, provide additional opportunities to practice specific skills being taught at that particular time, as well as provide a place for posting any variety of materials of interest generally to the students (Ray, 2006; Richardson, 2006).

This conceptualization and extension of the idea of blogging varies from many of the other uses explored in the literature. Current research profiles their many different uses as communication tools for reflection and sharing (Bruns & Jacobs, 2006). In this assignment, the emphasis is on the use of the Edublog as a tool for inviting their future students and their parents to participate as equal partners in the classroom learning journey and is introduced to the students at the very beginning of the term. Invitational learning is a concept that has been explored at great length by Purkey and Novak (1996) and this pedagogy is referred to constantly throughout this phase of classroom practice. Class discussions also reinforce the idea of constructivist knowledge creation and how inviting students to follow their interests through links posted to a teacher's Edublog enables the extension of classroom learning in areas chosen by the students rather than their teachers, which is the essence of constructivism (Duffy & Jonassen, 1992).

Pre-service candidates are shown examples of previously completed student EduBlogs as exemplars of what their finished products will look like and these exemplars are available to them throughout the term as they are posted to special pages as part of a class wiki. (See Illustrations 1 & 2) However, when they are first examined as a class using a SmartBoard for greater interactivity, the ways in which these EduBlogs invite school success are discussed at great length and examples from the exemplars are profiled. They are provided with a criterion checklist of the specific contents of their EduBlogs, which varies, as stated previously, from course to course, depending upon the subject of the course. Students could be asked to restrict the subjects of their posts to topics in Mathematics and Science at the pre-determined grade level OR they might be asked to restrict those posts to topics relevant to literacy skill development OR they might be asked to post something from each of four subject areas: Mathematics, Language Arts, Social Studies and Science. In addition to the content specific posts, they are expected to begin with a greeting to parents and students, as well as a general introduction to themselves and an invitation to engagement. They are finally expected to post links to web pages that might be of interest to the parents only and also to the students only unrelated to specific subject areas. (See Appendix A for an example of the criterion checklist.) This assignment is a culminating performance task completed by the end of the course so its contents and the progress of students towards its completion is chunked into little pieces.

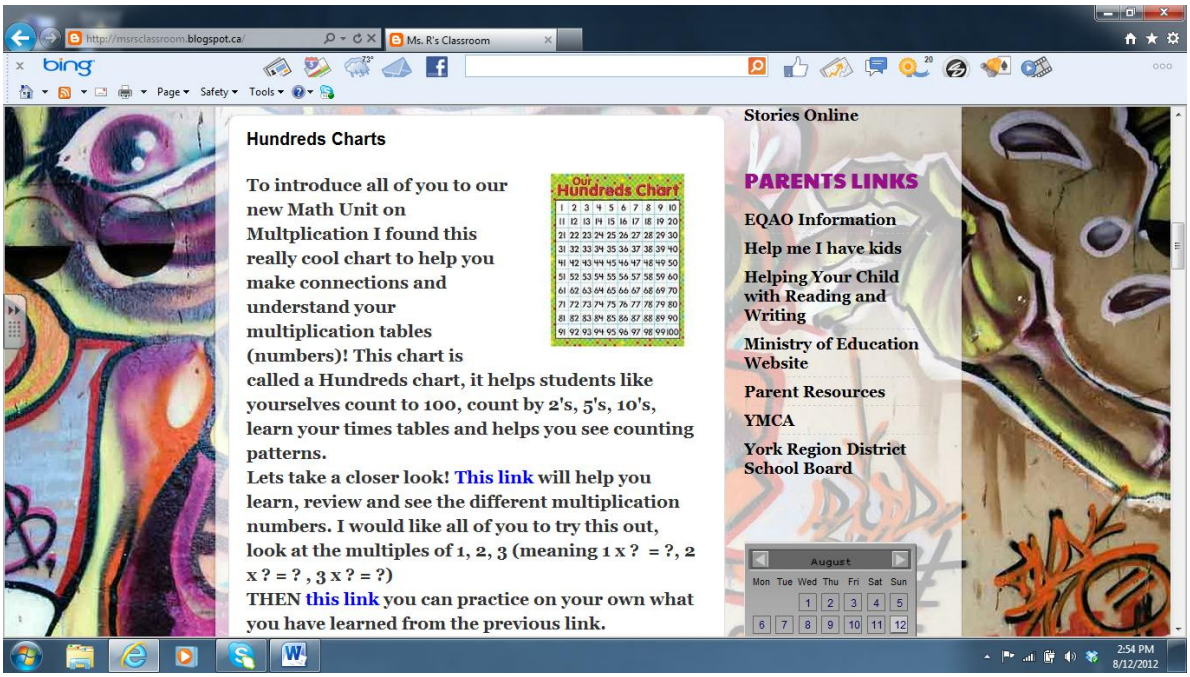

Figure 1

The nature of the task, as it has been outlined, enables the instructor to speak to and help students acquire an understanding of the requirements of age appropriate and subject appropriate web sites usable for classroom learning tasks. It enables a discussion of why certain sites would be more attractive and engaging for students and what sorts of issues teachers must consider when encouraging students to use the web as an extension of their classroom learning. It promotes discussions about the usefulness of the EduBlog as a communication tool between the home and the school. It facilitates discussions about design elements, colour, sound, and language as limitations of where students ought to be going when fulfilling classroom learning objectives. It prompts a conversation about the tone of a posting and its relationship to the engagement of its target audience. It finally encourages the use of words and phrases that help parents understand the link to the curricular outcomes that such extensions must be based upon. All of these skills and procedures are referred back to the concept of invitational learning. (Purkey & Novak, 1996) The rubric provided for the pre-service candidate that is used to assess the completed product speaks to all of these design and pedagogical elements. (See Appendix B for an example of the rubric for the task.)

When the task is first outlined in class, students are overwhelmed by the expectations of the assignment. They don't communicate this readily in the beginning but they admit to feeling that way AFTER they have completed the task. The first thing they are asked to do is go online to a free EduBlog site and begin the process of creating their EduBlog, then post itsurl (Universal Resource Locator) or address to a specially designated wiki page that enables the instructor to monitor the completion of the first stage. Throughout the course, students participate in discussions germane to the task, eg. choosing appropriate websites, linking postings to classroom tasks, what it means to use age-appropriate and invitational language, how to add various tools and utilities, how to choose graphics and the necessity to use free graphics, and the importance of perfection in written language skills. With each of these discussions and as part of any large or small group demonstrations to assist in the completion of the task, the students together with the instructor explore the pedagogy underlying the use of EduBlogs specifically, and more generally, technology in the classroom. In every case, short tutorials are prompted by students requesting guidance or assistance.

As briefly mentioned above, the Edublog assignment is a culminating performance task (Wiggins & McTighe, 2005) for each of the courses where it is used as a classroom assignment. As such, it is the last major task to be completed before the end of classes. It can be completed before that, but most students leave it till the last moment because they are often intimidated by the task. There is a steady flow of e-mail communications between the students and the instructor as they are required to inform the instructor when they are ready to have their assignment assessed. Invariably, in the body of these e-mail communications are included statements declaring the fear of getting started but once they got started, how much they enjoyed working on the task. Time and time again, they write of their pleasure in their finished work, their understanding and insight into how the EduBlog can be used pedagogically to enhance classroom learning as well as understanding this as a link between the home and the school. Although there is an implicit understanding that if there are mistakes made, these can be corrected and then the EduBlog reassessed, seldom is there any need to have students reconsider their work. Often, the e-mail will conclude with the comment that the EduBlog assignment was the most fun but also the most meaningful task of their entire term.

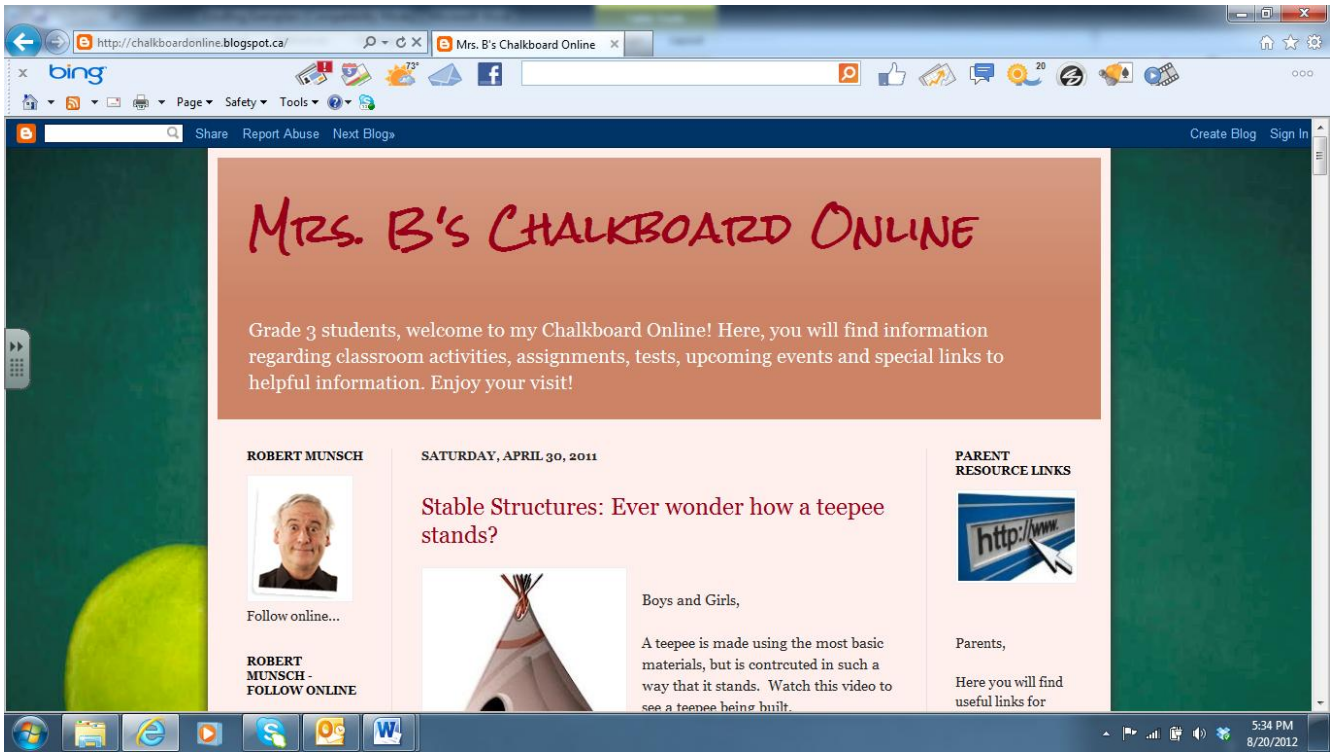

Figure 2

Surveying the Students As Follow Up

As part of a much wider and more comprehensive research project into the use of authentic tasks as a way to teach about technology and how to integrate it into the classroom, (to be reported on at a later date) a survey of students in several semesters of these methods courses was conducted and data gathered. Approximately 200 students were sent an e-mail requesting that they complete an online survey. They were informed that the survey was for the purposes of improving program and refining its delivery. They were also informed that completion of the survey indicated acquiescence to the research itself and the use of the data. This action research derived its methodology from the work of Bassey (1999), Creswell (1998), and Dooley (1995). Questions asked of the students specifically relating to the EduBlog assignment reported discussed in this paper included the following:

- What software / Web 2.0 tools have you developed some expertise with through these courses?
- Which of these same tools have you seen used in the classrooms you have been placed in as part of this program?
- Which of these tools have YOU used in your placements?
- Have you been asked by others in these placements to help them acquire some of the skills you have displayed?
- Which of these tools do you plan on using in your own future classrooms?
- Do you feel the classroom assignments have given you a better idea of how to integrate technology for teaching and learning purposes?
- Do you think the method of integration of technology learning coupled with authentic learning tasks helped you see how you could do the same thing in your future classrooms?
- Are you more or less confident about using technology in the future?

Responses to only these questions shedding light on the hypothesis that authentic, situated learning with reference to the topic of EduBlogs will be discussed in this paper.

Results and Discussion

Half the students (52.3%) who responded indicated that, through the assignment of an EduBlog, they had developed some expertise with their creation and use, although only 9.5% indicated any prior knowledge of this particular Web 2.0 tool. This would suggest that the assignment represented new learning for the vast majority of the students. Such a perception was informally validated by the continuous need to help most students understand what a blog as and how it might fit in to a teacher education program. Responding to the question of whether or not the respondents had seen EduBlogs in use the classrooms where they were placed for practice teaching opportunities, only 18.2% indicated that they had seen them in use. This would work against the desire to transmit to the students the utility and the desirability of an EduBlog.

When asked if EduBlogs were used in their practice teaching placements, the same percentage (18.2%) indicated that they had actually used EduBlogs as one of their classroom teaching and learning strategies. When asked if these student respondents intended on using this particular strategy as educators in the future, fully half or 52.3% indicated a positive intention. An overwhelming 90.2% suggested that integrating technology in their classroom assignments helped provide them with a vision of how technology will further teaching and learning goals with their future students. When asked if they thought the integration of technology as tools in classroom assignments was useful in helping them see how they could integrate technology, the response was positive in every instance. Similarly there was unanimous agreement to the question of whether using the technology authentically helped them develop confidence. Again, developing confidence and understanding how and why EduBlogs can serve teaching and learning goals will not result in change in classrooms of the future if, when in schools, new teachers don't see their colleagues using technologies like this.

While students were asked to respond to specific questions, they were also encouraged to include personal comments to some of the questions. With reference to the question concerning how the students used technology in their placements and how successful it was, one student wrote the following:

> "I created an Edublog for my Grade 3 placement. I gave the link in the initial letter
> I sent home with the students. The feedback I got from the students and parents
> was positive. ……Overall, I had fun using the edublog. I think it's an awesome tool……In my classroom, I will definitely enforce the use of an edublog right from
> September to get the most out of it. "

When asked whether using technology (which had to include the Edublog) to complete authentic assignments helped them envision how technology might be used in teaching and learning another student wrote:

> "You made me realize how effective technology can be in elementary classrooms.
> The varied programs available to use in classrooms extend lessons and scaffold student learning in ways I would never have thought of. Thank you."

Yet another commented with reference to the same question:

> "This course has given me a new-found perspective on the use of technology within
> The classroom, and the ways technology can inspire to develop academic growth and leadership."

Finally, when asked whether the integration of technology as tools to complete their assignments in general had provided them with the confidence to use technology on their own, students commented that: " seeing is believing" and "I am definitely more confident" and "technology is an important tool to enhance learning and the assignments helped us to practice and use these programs" and "I am grateful for the lessons on technology as I have gained more confidence and will continue using technology in classrooms." Clearly, learning how to create and use Edublogs as some form of a culminating performance task was a successful strategy. There are those want to follow through with the strategy out in the field in the future. However, there are others who, when confronted with colleagues who turn away from technology use, will conform and seek an easier but less productive way to engage their students.

It would only be fair to suggest that there were more than a few students who, while appreciating the ways in which EduBlogs can further classroom teaching and learning goals, admitted they would be intimidated by the idea of keeping them up to date.

Few found the actual postings difficult after acquiring the skills, but clearly, if 52.2 % intended to implement a blog in their future classrooms, 47.8% did not primarily because they were not convinced that technology was necessary. One could conclude that efficacy in the use of technology, the vision of how the technology can advance curricular goals, and the knowledge of how to create an Edublog were all in place but what was not is the cultural components encouraging the use of technology. This returns to the extant use of technology in the schools where these teachers are posted and it becomes a self-fulfilling prophecy. If there is technology being used already in a school, then it is not that challenging to go one step further. The survey question seeking to yield information on what was observed in terms of technology integration in the field placements yielded a strong positive response to Word (84.8%) , a somewhat strong positive response to Powerpoint (63.6%) but everything else was lower than 25%. This would tend to confirm the perception that what new teachers find extant in classrooms will be more rather than less likely to influence their own adoption of technology. Nothing sums up this perception better than two of the comments from respondents:

> "My host teacher really liked the idea of the EduBlog and was impressed by the creativity I put into it. She definitely understands its use but just felt that it was too much work to handle on top of all the class work."
> "I think many teachers are unsure and tend to stay away from technology."

Conclusions

Clearly, based upon the feedback on questions dealing with the EduBlog component of the course assignments or the over-all integration of technology into course materials from beginning to end, of the respondents surveyed, merely providing technology-rich learning experiences for pre-service students is, in and of itself, not always sufficient. As reviewed above, even though the pedagogical value of an Edublog was clear, and students even went so far as to use this tool as part of their practice-teaching repertoire, associate teachers admired the tool but felt they themselves wouldn't attempt to create one of their own due to the amount of work involved.

There will always be pioneers who will take a new idea and run with it, as almost 20% of the students in this sample said they had. Where EduBlogs were used in the classroom, there was confidence, a vision, a level of skill development and a high degree of success not only in their own eyes but also in the eyes of their supervising teachers and the students in their classrooms. This is sufficient success to motivate the continued use of the approach advocated in this paper. However it is disappointing that so many of our pre-service candidates find themselves in classrooms where technology use is still not a high priority. Subsequent to the writing of this paper, further data was collected supporting the assumption that this paper began with, that there are far too many classrooms where technology is not even available to the students, never mind being actively used by them or their teachers. This speaks to the role of classroom and school culture in seeing that once acquired in their program, candidates for classroom teaching actually turn around and use their skills as taught and practiced. This is the barrier that Polly, Mims, Shepherd and Inan (2009) referred to as a misalignment between teacher education programs and K-12 schools.

In order to fulfill Duncan's call for a revolution in teaching and learning, classroom teachers need to be guided towards acquiring the same vision that the newest students are entering the profession already possessing. Cuban (1986) reviewed the adoption of new technologies by classroom teachers over half a century of change, looking at the use of radios, televisions, overhead projectors and computers among other technologies. He found that invariably when teachers saw the technology as good for students, they were willing to make changes to their classroom programming and learn how to integrate the new methodology into their ways of doing things. Similarly, when the students in this survey sample were shown how useful and powerful EduBlogs were, they were convinced that there had to be a role for them in their classrooms. It was the negative perceptions or orientations towards technology in the classrooms of their supervising teachers that kept them from trying to do more.

This is not to say that all of the efforts to link technology and pedagogy have been unsuccessful. During my career as an educator, working with teachers in schools, I have seen how teacher behaviours can change radically and quickly when confronted with something that will save them time or make their classrooms better places and are provided with the opportunity to learn and practice the new skills that such change requires.

I have seen entire families of schools and all their teaching staffs adopt electronic reporting tools when they realized how productive it made their time and how much easier it was for them to create a class set of report cards. It is possible to affect change when there is a vision and teachers see, on a continuous basis, what that change might look like. My own previous doctoral research found how powerful the support of a consultant with vision could be in getting teachers to buy into creating classroom websites on various curricular topics (Slepkov, 2008). This research highlights how important the vision of the use of EduBogs in the classroom was in bringing students to a point where they were prepared to experiment with its use on their own. Our profession has to find ways to bring that vision to practicing teachers at a level where they can see, understand and then acquire that vision for themselves. Only then will they make the leap of faith required to implement that change for themselves in their day to day classroom practices and take advantage of the enthusiasm and technology skills 21st Century pre-service candidates bring to the gates of the profession.

References

Adey, P. (with Hewitt, G., Hewitt, J., & Landau, N.). (2004). *The professional development of teachers: Practice and theory*. Dordrecht, Netherlands: Kluwer Academic.

Anderson, T., & Kanuka, H. (2002). *E-research: Methods, strategies and issues.* Boston (MA): Allyn & Bacon.

Barlow, A. (2008). *Blogging America: The new public sphere.* Westport, CT: Praeger.

Bassey, M. (1999). *Case study research in educational settings.* Buckingham, (UK): Open University Press.

Bereiter, C. & Scardamalia, M. (1989). Intentional learning as a goal of instruction. In L. B. Resnick (Editor). *Knowing, learning, & instruction: Essays in honour of Robert Glaser.* Hillsdale (NY): Erlbaum.

Bielefeldt, T. (2001). Technology in teacher education. Retrieved 7/9/2002 at Intel Website: http://www.intel.com/education/iste/research01.htm

Brent, R., Brawner, C. E. & Van Dyk, P. (2002). Factors influencing student teachers' use of technology. *Journal of Computing in Teacher Education,* 19(2), 61-68.

Bruns, A. & Jacobs, J. (Editors) (2006). *Uses of blogs.* New York, NY: Peter Lang.

Cheon, J., Song, J., Jones, D. R.& Nam, K. (2010). Influencing pre-service teachers intention to adopt web 2.0 services. *Journal of Digital Learning in Teacher Education,* 27 (2), 53–64.

Clayton, J. F. (2003). *Using the internet to collect quantitative data.* Retrieved July 20, 2004 from Wintec, Waikato Institute of Technology website http://www.wintec.ac.nz/files/about20us/services/clt/withit/volume3/ ITPNZ_Clayton.doc

Collins, A. & Halverson, R. (2009). *Rethinking education in the age of technology: The digital revolution and schooling in america.* New York (NY): Teachers College Press.

Corbett, B. A. & Willms, J. D. (2002). Information and communication technology: Access and use.*Education Quarterly Review,* 8 (4), 8–15.

Creswell, J. W. (1998). *Qualitative inquiry and research design: Choosing among five traditions.* Thousand Oaks (CA): Sage.

Cuban, L. (1986). *Teachers and machines: The classroom use of technology since 1920.* New York, NY: Teachers' College Press.

Dooley, D. (1995). *Social research methods.*(3rd ed). Englewood Cliffs (NJ): Prentice-Hall.

Duffy, T. M., & Jonassen, D. H. (Eds.) (1992). *Constructivism and the technology of instruction.* Hillsdale, NJ: Lawrence Erlbaum Associates.

Duncan, A. (2011). Harness the power of technology. *Learning & Leading with Technology,* 38(8), 10–13.

Ertmer, P. A. & Ottenbreit-Leftwich, A. T. (2010). Teacher technology change: How knowledge, confidence, beliefs, and culture intersect. *Journal of Research on Technology in Education,* 42 (3), 255–285.

Ferriter, W. M. (2010). Preparing to teach digitally. *Educational Leadership,* 67 (8), *88* –89.

Heide, A. & Henderson, D. (2003). *Active learning in the digital age classroom.* Toronto (ON): Pearson.

Hewitt, H. (2005). *Blog: Understanding the information revolution that's changing your world.* Nashville, TN: Thomas Nelson.

Hurr, J. W., Cullen, T. & Brush, T. (2010). Teaching for application: A model for assisting pre-service teachers with technology integration. *Journal of Technology and Teacher Education,* 18 (1),161–182,

Kerr, S. T. (1991). Lever and fulcrum: educational technology in teachers'thought and practice. *Teachers College Record,* 93 (1), 114–136.

Kolb, D. (1984). *Experiential learning: Experience is the source of learning and development.* Englewood Cliffs (NJ): Prentice-Hall.

Kumar, S. & Vigil, K. (2011). The net generation as pre-service teachers: Transferring familiarity with new technologies to educational environments. *Journal of Digital Learning in Teacher Education,* 27(4), 144-153.

Kritt, D.W. & Winegar, L. T. (Editors) (2007). *Education and technology: Critical perspectives, possible futures.* Lanham(MD): Lexington Books.

Lambert, J. & Gong, Y. (2010). 21st century paradigms for pre-service teacher technology preparation. *Computers in the Schools,* 27 (1), 54–70.

Micheller, J. S. (1999). Building teacher capacity for authentic learning. *Leadership and the new technologies.* 7(Jan/Feb), 1-5.

Nicaise, M. & Barnes, D. (1996). The union of technology, constructivism, and teacher education. *Journal of Teacher Education,* 47(3), 205-212.

Oberlander, J., & Talbert – Johnson, C. (2007). Envisioning the foundations of technology integration in pre-service education. Paper presented at the Association of Teacher Educators, San Diego, CA. February 20, 2007.

Polly, D., Mims, C., Shepherd, C. E., & Inan, F. (2010). Evidence of impact: Transforming teacher education with preparing tomorrow's teachers to teach with technology (PT3) grants. *Teaching & teacher education,* 26(2010), 863-870.

Purkey, W., & Novak, J. (1996). *Inviting school success: A self-concept approach to teaching and learning (3rd ed.).* Belmont, CA: Wadsworth.

Rademacher, J., Tyler-Wood, T., Doclar, J., & Pemberton, J. (2001). Developing learner-centred technology assignments with student teachers. *Journal of Computing in Teacher Education,* 17(3), 18–25.

Ray, J. (2006). Welcome to the blogosphere: The educational use of blogs (aka edublogs). *Kappa Delta Pi Record,* 42(4), 175 – 178.

Richardson, W. (2006). *Blogs, wikis, podcasts, and other powerful web tools for classrooms.* Thousand Oaks (CA): Corwin Press.

Rosen, L. D. (2011). Teaching the i-generation. *Educational Leadership,* 68(2), 10-15.

Slepkov, H. (2008). Teacher Professional Growth in an Authentic Learning Environment. *Journal of Research on Technology in Education,* 41 (1), 85-111.

Swain, C. (2008). Are we there yet? : The power of creating an innovation configuration map on the integration of technology into your teacher education program. *Journal of Computing in Teacher Education,* 24 (4), 143 – 147.

Tapscott, D. (2009). *Grown up digital: How the net generation is changing your world.* Toronto(ON): McGraw Hill.

U. S. Department of Education, Office of Educational Technology (2010). *Transforming American Education : Learning Powered by Technology*. Alexandria (VA): Education Publications Centre, U. S. Department of Education.

Vannatta, R. A. & Beyerback, B. (2000). Facilitating a constructivist vision of technology integration among education faculty and pre-service teachers. *Journal of Research on Computing in Education,* 33(2), 132-148.

Wiggins, G. P. & McTighe, J. (2005). *Understanding by design.* Alexandria (VA): Association for Supervision and Curriculum Development.

Appendix A: Criterion Checklist for Classroom Edublog Assignment

Edublog Components	
	URL posted to CLASS WIKI designated page along with your name.
	The use of graphics throughout to illustrate the various themes of your blog page entries.
	No fewer than 7 completed posts (content will be graded using the Edublog Scoring Rubric). You must use a voice appropriate for students.
	Your posts must also convey information to the parents concerning the topics being covered and their links to the curriculum.
	Hyperlink url's hidden by appropriate text or naming as they would appear on a web page.
Blog Messages	
	Post #1 is a "welcome" to your students.
	Post #2 is a "resource" link with URL of an online tool that might be beneficial to your students and to their parents as well.
	Post #3 is a message that highlights 3 links that are relevant to any topics that might be dealt with in any week (games, ebooks, fun activities)
	Post #4 though 7 are messages that each highlight ONE or MORE links relevant to either Math or Science strand expectations from the Ontario Curriculum Standards. The strand expectation should be clearly explained and the links should support learning that concept ONLY. These links might be to games or a WebQuest or a Virtual Field Trip and might include additional materials or a video or anything you think will extend the learning in the classroom during the day.
	You must have at least two postings for Math and two postings for Science

When you create your blog, remember the following:

- ✓ Anyone in the world can read your blog. So, be very careful what you say and how you say it.
- ✓ Your blog should be a reflection of you, as a teacher, as well as of the content that you might be teaching. Make it warm, friendly, invitational, and personal.
- ✓ Having homework resources within your blog is a plus. Links to educational support sites, such as www.dictionary.com, limits student surfing and provides parents with tools to help their children.
- ✓ The mechanics of writing are exceptionally important when you are communicating with parents especially but your writing must always be an exemplar for your students.
- ✓ Keep your site upbeat, engaging, and informative.

Appendix B Classroom Rubric for EduBlog Assignment

Criteria	Level 4
Look	Makes excellent use of font, colour, graphics, effects, etc. to enhance the look and feel and navigation of the EduBlog. Colour and size are used as elements of the purpose of the posting. Graphics are an integral part of the EduBlog.
Content	Clearly covers both Science and Mathematics expectations in a meaningful and invitational manner. The written invitational part of the posting explains the pedagogical import of the posting and how following the links will help the students.
Links	There are at least two, preferably more links per educational concept or posting. All links are well chosen, educationally sound, and instructionally appropriate for the level of the students.
Standards Alignment	The educational standards associated with all the concepts are clearly stated within the postings. There is a clear instructional alignment between all standards and all concepts.
Writing	All educational concepts are clearly defined and explained so that students and their parents know what each activity is about. The language used is invitational for both parents and students.
Grammar and More	All postings are free of grammar, punctuation, spelling, and mechanical errors. Nothing enrages a parent more than seeing written language errors coming from things written by their child's teacher.
Organization	Content is well organized using headings or bulleted lists to group related material. Space is used well on the blog over-all.