UNIVERSITY OF CALGARY
WERKLUND SCHOOL OF EDUCATION

A Review of the Literature on

Rural and Remote Pre-Service Teacher Preparation

With a Focus on Blended and E-Learning Models

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A Message from the Research Team

The research team has prepared a review of the literature on rural and remote pre-service teacher education delivered primarily in blended or e-learning formats. We have focused our review on six (6) key topic areas. Though some relate directly to the delivery of teacher education in blended or e-learning formats, we also felt it was important to address related issues such as evaluation, the integration of technology in professional practice and last, but certainly not least, to understand the broader debate around delivering pre-service teacher education in technology-driven formats.

Given the breadth of these topics, the range of literature that we have surveyed is broad. We have consulted peer-reviewed academic journals, books, conference proceedings, government reports, reports from non-profit organizations and online materials. While we have endeavored to distill the authors' work and research accurately, we advise readers who are interested in more information to consult the original work. As a matter of course, when undertaking a summary of complex matters, some details must be left out.

We would like to thank the Research Office of Werklund School of Education, University of Calgary for providing us the means to complete this literature review with a WSE Enhancement Grant. We also offer our gratitude to those colleagues who have supported us in this work and offered us insights during our research.

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Executive Summary

I. Preparing Pre-service Teachers to Integrate Technology into their Professional Practice

- A technology-rich teacher training experience better prepares teachers to integrate technology into their professional practice. It is important for preservice teachers to have hands-on experience with technology during their training.
- Teachers have considerable influence over how their students end up using technology in the classroom. Teachers are perceived as the connector between learners and learning technologies. The way a teacher communicates with learners about technology can help to facilitate and improve a student-centred approach that integrates technology into the learning. It is important for teachers to send a positive message about the possibilities that technology can present for learning.
- Even today some preservice teachers have misconceptions about the validity and value of using technology. When teachers are skeptical or dismissive of technology for learning, they send a message that they do not support the idea of students improving their digital literacy skills.
- As a teacher's competence with technology grows, so too does his or her comfort level with the technology. When that happens, confidence develops and the teacher feels more prepared to integrate technology into their professional practice. Developing competence, comfort levels and confidence are key factors in whether or not a teacher is likely to integrate technology into their practice.
- Learning and integrating technology into learning requires time and patience. It may take longer to prepare and deliver a lesson that integrates technology.
- It is not enough for technology to be available or installed. The technology itself must be interactive and engaging for both learners and teachers in order for it to be considered valuable for the learning experience. Educational technology is most effective when it is connected to clearly defined learning tasks and goals, and supported by the teacher.

II. Pre-service Teacher Preparation Programs Delivered Online

- Preservice teachers who take online training must have adequate technology in order to successfully complete their courses. This includes, but is not limited to having hardware, such as their own computers to access whenever they want, as well as having excellent connectivity to the Internet and sufficient bandwidth. Educators sometimes struggle to come to terms with the fact that there may be a significant gap between what they envision online learning could be and what the reality of it is. It is important for program administrators, instructors and learners to maintain a realistic view of what is achievable in an online learning experience.

- Preservice teachers who feel less confident with technology can overcome their anxiety and fears if they are given adequate support. One-to-one mentoring, high levels of interaction with instructors, personalized feedback on assignments and developing a supportive online environment are key elements to helping online education students build their confidence throughout their program. Group workshops may be seen as a cost-effective model to deliver technology training, but that does not mean they are necessarily the most effective.

- For some preservice teachers, an online program is the only viable alternative. They must be fully supported in order to help them achieve success.

- Preservice teachers who are trained online may be better positioned for success as teachers of virtual schools than their professional counterparts who received their training in traditional face-to-face teacher education programs.

- Even in an online teacher training program, it is critical to have face-to-face field experiences so preservice teachers can experience the classroom environment as part of their training.

III. Pre-service Teacher Preparation Programs Delivered in a Blended Format

- Blended teacher education programs are not simply a stepping-stone to fully online programs, but are a valid alternative method of delivering pre-service teacher education in their own right. It is important to note that teacher education programs differ from other kinds of professional education programs because of the necessary elements such as field experiences and student teaching. These elements must be carefully considered when developing a blended teacher education program.
- A blended approach to field experience might include having face-to-face classroom experience, combined with online reflections and discussions with peers and instructors.
- Preservice teachers trained in a blended program may develop a greater sense of community and have fewer feeling of isolation than those who take their teacher education in a fully online environment. Leaving discussion boards open to students after their courses end is one way for new alumni to continue cultivating a sense of professional community with their peers.
- Technology must be incorporated with a sense of intentionality and purpose in a blended pre-service teacher education program. It is important for pre-service teachers to explicitly understand how and why technology is being integrated into their training and that using technology for its own sake is neither useful, nor helpful. Technology must be relevant to a teacher's professional context.
- Instructors must make preservice teachers aware that the online component of their program may require a significant investment of time. Simply because a program is partly online does not mean that it will require less time or effort. On the contrary, time management is a key element to success in online and blended learning.

IV. Technology-focused Pre-service Teacher Preparation in Rural and Remote Communities

- Student computer access remains a significant challenge in rural and remote areas. Barriers to effectively integrating technology into rural and remotes schools include having adequate connectivity (bandwidth); lack of technical support in schools and lack of training and professional development for teachers.
- Enhancing the technology literacy of rural and remote teachers is essential for them in order to develop the competence and confidence to successfully integrate technology into their teaching practice.
- Even when rural and remote teachers demonstrate positive attitudes towards using technology for learning, providing them with support is essential to help them integrate it into their professional practice.

V. Critical Perspectives of Technology for Learning

- Critics are skeptical that teacher education can be effectively delivered in any format other than face-to-face instruction.
- Administrator perceptions of online preservice teacher education are more negative than positive. In particular, there is concern that the social aspects of teaching may be compromised when delivered in an online or blended format. As a result, administrators in charge of hiring may be reluctant to hire students graduating from online or blended programs.
- Lack of support from institutional administration can be a significant barrier to developing or investing in resources or programs requiring technology. This may be because such decisions are perceived to be made according to the beliefs of those who support technology, rather than substantive evidence of the effectiveness of technology for learning.
- Drawbacks of online and blended preservice teacher education include excessive demands on the time of both those enrolled and those teaching in the program. Beliefs about how difficult technology may be to use also played a key barrier to integrating technology into learning.
- The amount or availability of technology does not seem to matter as much as its reliability. When resources do not work or require troubleshooting, or the steps to set up the technology are cumbersome, technology becomes a burden rather than an asset. When that happens, teachers may abandon technology in favour of tried and true traditional resources that can be used at a moment's notice.

VI. Monitoring, Evaluating and Assuring the Quality of e-Learning and Blended Learning Programs for Teacher Education

- Program evaluation has traditionally focused on how processes and systems lead to desired outcomes. In education, such outcomes are often not valid indicators of success.
- The evaluation of online and blended education programs often focus on the effectiveness of the technology, rather than the learning.
- The evaluation of pre-service blended and online teacher education seems to be in its infancy and effective methods have yet to be developed to adequately assess the effectiveness of how well such programs prepare teacher for their future professional practice.

Terms of Reference

This report provides an overview of the current literature relating to technology and pre-service teacher education across a variety of themes:

1. Pre-service teacher preparation that integrates innovation and technology in a variety of ways
2. Pre-service teacher preparation that is delivered exclusively via an online program
3. Pre-service teacher preparation that is delivered via a blended (e-learning and face-to-face) program
4. Technology-focused pre-service teacher preparation for educators working in rural and remote contexts
5. Critical perspectives of technology-driven teacher preparation and PD
6. Evaluation and quality assurance for technology in pre-service teacher preparation programs

This report builds upon the work previously done by Mr. Merlin Thomspon, a graduate student under the supervision of Dr. Dianne Gereluk.

The aim of this report is to provide a general overview of the key themes, but the review of the literature is neither exhaustive nor exclusive.

Background on pre-service teacher education in rural and remote communities

Terms "rural" and "remote" communities are contested and sometimes complex. Does population determine whether a community is defined as urban, rural or remote? Or do factors such as infrastructure such as the number of schools or hospitals play a role in the definition? A definition of rural may be as simple as "not urban" and the term remote may not be easily definable at all (Northern Alberta Development Council, p. 3).

What is clear though is that attracting and retaining teachers for rural and remote areas is a pervasive global problem (Canter, Voytecki, & Rodríguez, 2007; West & Jones, 2007; Grant, 2010). Canada is not immune to these issues (Saskatchewan Learning, 2007; Ontario Ministry of Education, 2008; Nova Scotia Department of Education, 2012; Alberta Education, 2013). Although this situation is historical, in recent years the teacher shortage has become worse (Manitoba Education, Training, and Youth, 2002; Kitchenham & Chasteauneuf, 2010; Northern Alberta Development Council, 2010). Aboriginal communities are especially vulnerable (Dragon et al., 2012). There is simply not enough access to teacher certification for individuals in rural and remote areas (Grant, 2010) and teacher recruitment "affects the delivery of quality educational services in rural and remote areas including reserve schools" (Mueller, Carr-Stewart, Steeves, & Marshall, 2011, para. 1). Solutions perceived as radical within the political and educational community are required (Dibbon, 2001). The Northern Alberta Development Report recommended that Alberta communities make an increased priority to recruit local teachers with the proposed solution of "growing our own teachers" (Northern Alberta Development Council, 2010, pg. 11).

There is a demand for qualified and competent teachers in rural and remote areas and yet, potential students have little access to teacher education programs unless they move to an urban center or a satellite campus (Alberta Education, 2013). While some blended and online pre-service teacher education programs exist in countries like the United States and Australia, a preliminary web search reveals that most are limited to elementary and early childhood education. In Canada, there are limited online or blended Bachelor of Education programs that lead to teaching certification. Current programs in Canada that target rural and remote students require them to move to larger centers or satellite campuses to receive pre-service teacher education through face-to-face instruction. If they leave their rural and remote areas to attend post-secondary

institutions, 77% will not return to their communities (Dupuy, Mayer, & Morisette, 2000). Students who live at a distance from urban universities are at a disadvantage.

Rural and remote teachers will teach students through technology and some of those teachers will teach online as well as face-to-face classes, yet, they will do so without having been given the experience of online learning or having had online teaching made explicit. Grant (2010) maintained that pre-service teachers trained through online instruction are better positioned to prepare today's youth for the digital global economy. Pre-service teachers trained online may increase capacity for integrating technology in the classroom (Olson & Werhan, 2005), and e-learning may enhance the engagement of students during their program by having 24/7 access to learning (Rowley & O'Dea, 2014).

I. Preparing Pre-service Teachers to Integrate Technology into their Professional Practice

This section surveys literature focused on the integration of technology and innovation into already-existing teacher education programs. The interventions and innovations included the introduction of new technologies to enhance or enrich teacher-preparation programs.

- A technology-rich teacher training experience better prepares teachers to integrate technology into their professional practice. It is important for preservice teachers to have hands-on experience with technology during their training.
- Teachers have considerable influence over how their students end up using technology in the classroom. Teachers are perceived as the connector between learners and learning technologies. The way a teacher communicates with learners about technology can help to facilitate and improve a student-centred approach that integrates technology into the learning. It is important for teachers to send a positive message about the possibilities that technology can present for learning.
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Ajayi, L. (2009). An exploration of pre-service teachers' perceptions of learning to teach while using asynchronous discussion board. *Educational Technology & Society, 12*(2), 86-100.

This article examines 33 pre-service teachers' perceptions of using an asynchronous discussion board (ADB) as a tool to learn to teach. The results were positive showing that students perceived the ADB to situate learning and present opportunities for customized learning. Ajayi notes the link between using technology for personal communication and for learning, noting that an understanding of today's pre-service teachers, "should start from an appreciation that technologies such as cell phones, television, computers, video, iPods, personal data assistant, (i.e. blackberry), etc. play a major role in their everyday social interactions. As such, it is reasonable to assume that they have been apprenticed to the use of technology through communities of practice (home, peer groups, work) and can apply technological skills in academic contexts" (p. 87). A chart noting the differences between traditional classroom learning and ADB shows that the technology may lend itself to a more learner-centred approach (p. 88). The results indicated that students engaged in more peer-to-peer learning and felt motivated to read over lecture notes. 70% of participants reported that using the ADB forced them to think about how they themselves would incorporate technology into their own teaching practice. A concluding comment of the article was that having pre-service teachers use technology in their courses better prepared them to integrate it into their teaching practice and that the experience of having used technology themselves was advantageous.

Bigatel, P. M., Ragan, L. C., Kennan, S., May, J., & Redmond, B. F. (2012). The identification of competencies for online teaching. *Journal of Asynchronous Learning Networks, 16*(1), 59+.

This study examined teaching behaviours, attitudes and beliefs about competencies for online teaching success. Biatel, Ragan, Kennan and Redmond (2012) administered a survey to participants (n=197) with experience in online teaching. Results showed that communication is perceived as very important, as was active student-centred teaching. Furthermore, instructors are perceived as the "connector" between the learner and the learning system. Instructor competence and confidence using technology were also perceived to be very important.

Canter, L. L. S., Voytecki, K. S., & Rodríguez, D. (2007). Increasing online interaction in rural special education teacher preparation programs. *Rural Special Education Quarterly*, 26(1), 23-27.

This article examined strategies to integrate online distance education into special education teacher preparation programs, with a particular focus on preparing teachers in rural contexts. Canter, Voytecki and Rodríguez point out that, "Preservice teachers from rural backgrounds often face non-academic challenges that prevent them from pursuing a degree in education. One very prominent challenge is the preservice teacher's proximity to a university." (p. 23) Online distance education is seen as one way to reach out to prospective teachers in rural areas. One caveat is that in order for e-learning to be engaging, it must be active and "enhance the meaningfulness of content knowledge" (p. 23). A variety of strategies to engage learners include video conferencing, discussion board, listservs, e-mail, chat, teleconference, audio-conference, blogs and activities requiring students to use the Internet for learning. The authors concluded that in order for this type of education to be successful, it must be interactive and engaging.

Chelliah, J., & Clarke, E. (2011). Collaborative teaching and learning: overcoming the digital divide? *On the Horizon, 19*(4), 276-285.

This article examined the rapid growth of technology in educational contexts, pointing out that there is a parallel between the increasing use of technology for learning and the development of 21st century learning skills such as problem-solving, collaboration and self-regulated learning. Chelliah & Clarke (2011) point out that "technology by itself cannot change the nature of classroom instruction unless educators are able to evaluate and integrate the use of that technology into the curriculum" (p. 276). They note that technology fluent students of the 21st century expect web-supported resources and learning experiences to be integrated into their learning, but educators (often from a generation older or two older than their students) may be skeptical or resistant, thus contributing to a digital divide in curriculum development level. Not only do learning materials need to be digitized, but learning organizations themselves may need to abandon the "one size fits all approach" of decades past and learn to use technology to address the needs and wants of digital native students.

Chen, C.-H., Liao, C.-H., Chen, Y.-C., & Lee, C.-F. (2011). The integration of synchronous communication technology into service learning for pre-service teachers' online tutoring of middle school students. *The Internet and Higher Education, 14*(1), 27-33.

This study details research conducted with 18 Taiwanese pre-service teachers in tutoring middle-school students online using synchronous communication tools. One objective of the study was to elevate pre-service teachers' understanding of how to apply instructional theory and pedagogy in an online environment. The study also examined pre-service teachers' and students attitudes towards online learning and the effectiveness of online tutoring. Findings revealed that antiquated technology at the schools, poor Internet connection and equipment stability proved to be major obstacles to the success of the program. Pre-service teachers also reported they were unable to prevent students from multi-tasking while online (e.g. playing games or browsing websites) and that student distraction was difficult to overcome. Of note was that during a major weather incident (typhoon) when the government shut down schools, the online tutoring project was able to proceed. Overall, teachers reported they felt the project was successful in that they learned that they felt their teaching skills had improved, as they endeavored to enhance their own instruction by finding creative ways to keep students engaged (e.g. playing videos instead of just reading text.) A key result was that up-to-date hardware with a stable and reliable connection, along with tech support are key to a successful online learning environment.

Compton, L., Davis, N., & Correia, A.-P. (2010). Pre-service teachers' preconceptions, misconceptions, and concerns about virtual schooling. *Distance education, 31*(1), 37-54.

In this study Compton, Davis & Correia (2010) analyzed participants' personal journals and online discussion postings (n=65) to identify perceptions and misconceptions about virtual schooling. Misconceptions included career threat, academic dishonesty and lack of rigor in virtual schooling. It was noted that it may be necessary "to redesign the curriculum in the pre-service program to prompt and support conceptual change" in terms of virtual schooling (p. 38) and that "pre-service teachers enter their teacher education programs with a wide range of preconceptions and misconceptions about teaching and learning" (p. 38).

Compton, Davis & Correia (2010) found that "prior online distance education experience of participants, particularly the lack of such experience or experience of poor quality courses, strongly influenced misconceptions" (p. 42). There were differences among responses from different disciplines with those specializing in English being the most skeptical (p. 43).

The results of the study showed that misconceptions can be corrected and pre-service teachers' perceptions of virtual schools can be improved though dialogue and directed conversations meant to address these issues.

Díaz Soto, L. (2007). Teacher education using online resources. *Praeger handbook of Latino education in the U.S.* Retrieved from http://literati.credoreference.com/content/entry/abclatinoed/teacher_education_using_online_resources/0

Díaz Soto outlines a project to build teacher capacity to integrate online resources into the teaching of literature. The objectives included having teachers work with technology tools such as digital cameras and scanners to create "knowledge products" (p. 2) such as slide presentations to use with learners.

Dragon, K., Peacock, K., Norton, Y., Steinhauer, E., Snart, F., Carbonaro, M., et al. (2012). Digital opportunities within the aboriginal teacher education program: A study of preservice teachers' attitudes and proficiency in technology integration. *Alberta Journal of Educational Research, 58*(2), 263-285.

This study examined preservice teachers' (n=20) perceptions of educational technology in a post-secondary, Aboriginal, elementary teacher education program over a two-year period. Dragon et al. (2012) note that there is "a shortage of Aboriginal elementary teachers, especially in remote communities, who possess the necessary technology integration skills to support teaching and learning" (p. 265). In this study participants were provided with laptops, educational software and wireless Internet access cards to use in class, at home and during their practicum experiences.

Dragon et al. (2012) note that, "teachers who believe in the benefits of technology in their teaching practice persevere through challenges that face classroom educators" (p. 267).

Results showed that participants experienced frustration with the additional time required to learn new technologies and uneven levels of technology knowledge within the cohort (p. 277). Participants also acknowledged that having a laptop was useful in accessing their work with more convenience and flexibility. Further, the study showed that students' perception of technology improved over time and their self-ratings of computer efficacy significantly increased over time (p. 278).

Efe, R. (2011). Science student teachers and educational technology: experience, intentions, and value. *Educational Technology & Society, 14*(1), 228-240.

This study surveyed 448 pre-service science teachers to assess their experience with educational technology, intentions to use technology in their own teaching and beliefs about educational technology. The findings revealed that pre-service teachers who were more experienced with technology expressed greater intentions of using technology with their own students (p. 228). Efe notes that, "Educational technology has an effective role in moving from teacher-centered learning activities to student-centered learning activities" (p. 228) and that "if a teacher believes in the usefulness of educational technology, it will be easier for him/her to implement educational technology in the classroom and acquire the necessary related skills" (p. 229).

Efe (2011) points out that providing pre-service teachers with the opportunity to use and engage with technology during their teacher training gives them the opportunity to both learn the necessary skills and build their confidence enough to later implement technology in their teaching practice (p. 232), stating that "Actual classroom technology experience was a critical component that contributed to student teachers' future computer usage" (p. 232).

Two key elements seemed to be enhancing pre-service teachers' exposure to educational technology during their teacher training and developing their sense of confidence using these tools. Efe concluded that "it is important to adequately train student teachers to use educational technology since their experiences increase their chances of using educational technology in the classroom. When a student teacher's confidence in using educational technology elevates, his/her belief in the value of educational technology also increases" (p. 238).

Jang, S.-J. (2008). The effects of integrating technology, observation and writing into a teacher education method course. *Computers & Education, 50*(3), 853-865.

In this study, Jang conducted a study with 134 Taiwanese pre-service teachers to compare and contrast those enrolled in a traditional course (n=62) versus those who were taught the integration of asynchronous technology for writing (n=72). The study found a statistically significant difference between the two groups in terms of their perceptions about how much methodology they felt they learned and their interactivity with students. The research participants reported higher levels of awareness of the methodology they were learning and higher levels of interactivity with students. One downside of using technology was that students did not receive immediate feedback. The results concluded that the integration of technology in pre-service teacher education may help teachers to simultaneously develop both their methodology and their technological capacity.

Koch, A., Heo, M., & Kush, J. (2012). Technology integration into pre-service teacher training. *International Journal of Information and Communication Technology Education, 8*(1), 1-14.

This study surveyed 369 education students' perceptions of their own competencies with technology. The results indicated that "although teacher candidates left their coursework feeling confident in their ability to integrate technology, their skills nevertheless increased following real world experiences that allowed them to see direct results of their instruction through the learning of their students" (p. 9). The authors concluded that "when pre-service teachers experience both modeling of pedagogy and applied integration of technology they are considerably more likely to successfully extend these experiences to their classrooms following graduation" (pp. 9-10).

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

This study involved 100 pre-service teachers were surveyed to determine subjects' attitudes towards technology. The study found that pre-service teachers' prior exposure to technology correlated positively to attitude. As teachers used technology more, they developed higher levels of competency and confidence. The results revealed that pre-service teachers "are capable of learning a more advanced curriculum that simultaneously includes technical skill training and conceptual development related to pedagogy, content and 21st century skills" (p. 66). Lambert & Gong point out that teachers "inherently want to see learning happen when they teach" (p. 67) and that

teachers will "need valid reasons to use technology" (p. 67) as part of their professional practice.

Landge, P. S., Kamble, V. A., & Dange, A. S. (2010). *A virtual learning community for teacher education.* Paper presented at the 3rd IEEE International Conference on Computer Science and Information Technology (ICCSIT), 2010 Chengdu.

This project began with the creation of an online digital video database. This study examined how participants (n=3) used the database to build a virtual learning community to share experiences about their first teaching practicum in their teacher education program. The video database included an online discussion platform where users could exchange comments and ideas.

The conclusions revealed that the digital video server designed and developed for this study forced users to submit their work in a standardized format that all participants could access easily. This facilitated the sharing phase of the learning task. Standardizing the format of the content was seen to be a key to building a successful virtual community centered around sharing videos.

Mackey, J., Davis, N., & Dabner, N. (2012). Relevant, current and sustainable digital strategies to prepare future teachers to lead e-learning. *ASCILITE - Australian Society for Computers in Learning in Tertiary Education Annual Conference, 2012*(1). Retrieved from http://www.editlib.org/p/42651/

This paper was written as a response to criticisms that New Zealand teacher education providers were failing to prepare beginning teachers in terms of building their competence and confidence with e-learning. Mackey, Davis & Dabner (2012) explained that pre-service teachers' were given a formal introduction to the learning management system (LMS) and offered support in a variety of forms including an e-learning support site and the recruitment of a peer-mentor team.

Martinovic, D., & Zhang, Z. (2012). Situating ICT in the teacher education program: Overcoming challenges, fulfilling expectations. *Teaching and Teacher Education, 28*(3), 461-469.

This study took place over a two-year period with a total of 87 subjects (23 in year 1 and 64 in year 2) participated in focus groups. These were sourced from a larger group who had taken an online survey (N = 135 in year 1).

Mueller, J., Wood, E., Willoughby, T., Ross, C., & Specht, J. (2008). Identifying discriminating variables between teachers who fully integrate computers and teachers with limited integration. *Computers & Education, 51*(4), 1523-1537.

In this study, Mueller, Wood, Willoughby, Ross & Specht (2008) surveyed 185 elementary and 204 secondary teachers to develop a summary of characteristics of teachers who integrate technology into their practice and those who do not. Results showed that positive experiences teaching with computers; a teacher's comfort level; beliefs about the befits of technology; training and support and a teacher's own perceived efficacy level all impacted whether they were likely to use technology to teach.

The results showed that the number of years of teaching experience had little effect on whether teachers were likely to integrate technology into their practice. Comfort levels and hands-on experience using the technology were more predictive factors. The higher the levels of use and comfort, the more likely the teacher is to integrate technology.

Ottenbreit-Leftwich, A. T., Brush, T. A., Strycker, J., Gronseth, S., Roman, T., Abaci, S., et al. (2012). Preparation versus practice: How do teacher education programs and practicing teachers align in their use of technology to support teaching and learning? *Computers & Education, 59*(2), 399-411.

This project aimed to answer the question: "What are the similarities and differences between the technology topics included in preservice teacher education programs and the technology topics teachers find relevant and meaningful to their teaching/learning practices?" (p. 401). The researchers used a mixed methods approach including surveys

and interviews, with participants from over 400 U.S. post-secondary institutions (n=426).

The results showed that both pre-service and in-service teachers were most interested in learning about technology that increased their productivity and in particular communications; taught them about the learning management systems (e.g. grade books); electronic resources such as online databases; tools to engage students in immediate learning (e.g. clickers, immediate feedback, etc.); technology to support higher-order thinking skills; and personal learning networks. The researchers concluded that further dialogue is needed between those who plan and implement teacher education programs and those who actually work in the classroom, when it comes to determining what kinds of technology are most relevant and useful to practicing teachers.

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 and Teacher Education, 26*(4), 863-870.

This study used the TPACK framework to analyze findings from the U.S. Department of Education's "Preparing Teachers to Use Technology (PT3)" initiative. Findings revealed that creating technology-rich instruction in pre-service teacher education programs field experiences, along with supporting teachers with individualized mentorship were key factors in increasing teachers' capacity to use technology. Barriers to capacity building included finding technology-rich field experiences and inexperience among university faculty who were insufficiently supported as they learned to use technology themselves.

Reich, J., Levinson, M., & Johnston, W. (2011). Using online social networks to foster preservice teachers' membership in a networked community of praxis. *CITE Journal, 11*(4).

This study examined 22 pre-service teachers in a social studies methods course as they engaged in asynchronous discussions within the National Council of the Social Studies Ning. Participants engaged not only with each other, but also with other Ning members worldwide. Findings revealed that the pre-service teachers' experiences were enriched through dialogue with a broad global audience. In addition, the Ning provided an

appropriate venue to develop an online community of praxis where members leveraged social networking technologies to learn. Drawbacks included insufficient methods to hold students accountable for their participation. A key learning of the project was that "Technology alone is not as engaging as technology in the service of clearly defined learning goals with clear support and expectations" (395).

Rock, M. L., Gregg, M., Gable, R. A., & Zigmond, N. P. (2009). Virtual coaching for novice teachers. *The Phi Delta Kappan, 91*(2), 36-41.

This article discussed strategies and methods to attract, and then support, pre-service teachers into certain hard-to-fill subject areas, such as special education. Strategies included providing regularly scheduled virtual coaching sessions, supplementary "booster sessions" when needed and opportunities for peer-to-peer support and coaching.

Sang, G., Valcke, M., van Braak, J., & Tondeur, J. (2010). Student teachers' thinking processes and ICT integration: Predictors of prospective teaching behaviors with educational technology. *Computers & Education, 54*(1), 103-112.

This study, conducted in China, surveyed 727 pre-service teachers about their perceptions of technology including constructivist teaching beliefs, teacher self-efficacy, self-efficacy using computers, attitudes towards computers and prospective computer use. Finding revealed that respondents holding stronger constructivist teacher beliefs, and strong self-efficacy both as teachers and users of technology and more favorable attitudes towards technology showed more interest in integrating technology into their teaching practice. Sang, Valcke, van Braak and Tondeur conclude that "Teacher education should be carried out in constructivist learning environment and provide student teachers with a conducive and non-threatening environment to experience success in using the computers. This will allow them to gain competence and confidence in using computers for teaching and learning" (p. 109).

Schrum, L., Burbank, M. D., & Capps, R. (2007). Preparing future teachers for diverse schools in an online learning community: Perceptions and practice. The Internet and Higher Education, 10(3), 204-2011.

This study provided an example of one institution's endeavor to meet the need to prepare pre-service teachers to work in diverse classrooms. Thirty-eight (n=38) students participated in the study. Schrum, Burbank and Capps found that, "that electronic discussions provide platforms for unearthing perspectives that often remain hidden in more "public" face-to-face classroom settings.

In addition, the blended nature of this course made it different from fully online courses (traditionally individualized, isolated learning environments) in that it incorporated community site visits and student- to-student discussion of experiences at the sites" (p. 210). The findings suggest that online pre-service teacher education should include a classroom component, in order to best prepare teachers to teach in a classroom environment. The researchers conclude that "the best online teacher preparation courses maybe those that blend virtual and face-to-face interaction rather than being strictly online" (p. 204).

II. Pre-service Teacher Preparation Programs Delivered Online

This section surveys literature focused on pre-service teacher education programs delivered entirely in an online format.

- Preservice teachers who take online training must have adequate technology in order to successfully complete their courses. This includes, but is not limited to having hardware, such as their own computers to access whenever they want, as well as having excellent connectivity to the Internet and sufficient bandwidth. Educators sometimes struggle to come to terms with the fact that there may be a significant gap between what they envision online learning could be and what the reality of it is. It is important for program administrators, instructors and learners to maintain a realistic view of what is achievable in an online learning experience.

- Preservice teachers who feel less confident with technology can overcome their anxiety and fears if they are given adequate support. One-to-one mentoring, high levels of interaction with instructors, personalized feedback on assignments and developing a supportive online environment are key elements to helping online education students build their confidence throughout their program. Group workshops may be seen as a cost-effective model to deliver technology training, but that does not mean they are necessarily the most effective.

- For some preservice teachers, an online program is the only viable alternative. They must be fully supported in order to help them achieve success.

- Preservice teachers who are trained online may be better positioned for success as teachers of virtual schools than their professional counterparts who received their training in traditional face-to-face teacher education programs.

- Even in an online teacher training program, it is critical to have face-to-face field experiences so preservice teachers can experience the classroom environment as part of their training.

Banegas, D. L. (2014). Motivating factors in online language teacher education in southern Argentina. *Computers & Education, 76*, 131-142.

This study examined a pre-service language teacher education program in Patagonia, Argentina, a region that offers no face-to-face teacher education programs. Participants (n=71) completed an online survey and subsequently a percentage (n=24) participated in a follow-up interview. Findings revealed that three key elements to the participants' success were the possibility of receiving a teaching degree, learner autonomy and individual activities. Challenges in an online teacher education program included assessment (i.e. exam) security and student engagement. Demotivating factors for students included a lack of face-to-face contact with instructors and only minimal feedback on assignments. Respondents expressed a desire for in-depth and personalized feedback on their work. Bandegas pointed out that participants must have adequate access to both a computer and the Internet in order to complete their course work.

Brown, A. L. (2014). Implementing active learning in an online teacher education course. *American Journal of Distance Education, 28*(3), 170-183.

This study compared first-year pre-service teachers enrolled in a face-to-face course (n=61) versus those enrolled in an online version of the same course (n=54). Success was measured in terms of final course grades and no significant difference between the two groups was found. However, findings revealed that the online group showed significantly more growth in terms of their development of higher-level thinking (including critical, logical, reflective, metacognitive and creative thinking) particularly when posting to the online discussion board. Brown concluded that, "the increase in the preservice teachers' use of higher-level thinking skills from the beginning of the course to the end of the course seems to indicate that the intentional use of active learning strategies in the online course had an effect on the preservice teachers' development of higher- level thinking" (p. 177).

Clary, R., & Wandersee, J. H. (2009). Can teachers learn in an online environment? Through anonymous surveys, teachers enrolled in online science courses reflected on the activities and methods they encountered. *Kappa Delta Pi Record*, 34-38.

Clary & Wandersee note that convenience may be the primary motivating factor as to why teachers enroll in an online teacher education program, but that skepticism remains as to their effectiveness (p. 35). In particular, subjects that have traditionally been taught using a hands-on approach, such as science, online classes and teacher training may not be effective (p. 35). They note that, "As expected with any new learning environment and diverse group, some teachers felt the online environment extremely conducive to learning, while others were more overwhelmed initially. Retention in the courses was excellent, though. Some practicing teachers who expressed initial angst at assignments later reported that they over-came their fears and thoroughly enjoyed independent investigations" (pp. 36-37).

In a survey administered to over 600 teachers enrolled in an online program, the results showed that, "For some of these teachers, online was their *only* possibility for furthering subject knowledge. Fortunately, our research demonstrated that online learning environments can offer viable choices to teachers" (p. 38). The researchers concluded that while some teachers may initially feel overwhelmed, this can be overcome by offering appropriate support.

Downing, J. J., & Dyment, J. E. (2013). Teacher educators' readiness, preparation, and perceptions of preparing preservice teachers in a fully online environment: An exploratory study. *The Teacher Educator*, 48(2), 96-109.

In this study, teacher educators working a fully online teacher education program (n=27) completed a questionnaire designed to assess their perceptions of their own readiness to teach online. Results showed that the faculty were divided on whether an online classroom was an appropriate method to prepare pre-service teachers. Faculty further reported that they themselves lacked confidence and competence in technological and pedagogical skills needed to teach in an online teacher education program.

Despite these results, 59% reported that they were willing to teach online, providing they were given sufficient support to do so (p. 101). Sixty-seven percent (67%) reported that they felt they lacked the skills develop online course materials, while 81% of the academics surveyed believed they lacked the pedagogical knowledge to teach well in an online environment (p. 102). When asked what kind of support they found most useful, 49% ranked individual support as being the most useful and 49% ranked group workshops as being the least helpful form of support (p. 103). Downing and

Dyment comment that, “Based on these responses, it becomes clear that individualized attention offers significantly more than is possible in the larger formal workshops” (p. 103) and that “it is recommended that appropriate amounts of time are allocated to academics to firstly acquire the pedagogical and technical skills and then to operate within an online classroom” (p. 106). Another recommendation included have ample “at elbow” personalized support for faculty who teach online in order to develop both competence and confidence.

Grant, A. C. (2010). Tearing down the walls: creating global classrooms through online teacher preparation programs. *Distance Learning*, 7(2), 37-41.

In this position paper, Grant asserts that “Preservice teacher education delivered online better positions classroom instructors to prepare our [American] nation’s digital youth for the emerging global community as compared to traditional brick-and-mortar teacher education programs” (p. 37). Grant offers examples of how technologies are being used by teachers in classrooms across America, noting that participants of online preservice teacher preparation programs build their technology proficiency and “learn to troubleshoot technology and build a catalog of technology best practices to be used in their own classrooms” (p. 39).

Miller, N. C. (2012). Online teacher candidates' experiences in a virtual world for the preparation to teach middle school (Order No. 3546554, Mississippi State University). ProQuest Dissertations and Theses. Mississippi State University.

This thesis explored the use of a multi-user virtual environment (MUVE) for teacher preparation. Participants included online middle-school teacher candidates. The results showed that participants felt supported and engaged, but that personal and technical issues proved to be distractions to the experience.

Muirhead, W. D. (2000). *Teachers' perspectives of online education in Alberta.* University of Alberta, Edmonton.

This study examined emerging issues with teaching and learning online in Alberta, with teachers from online schools in four jurisdictions (n=13) as participants. The results showed that teachers’ responsibilities evolved and increased as they added in the responsibility of authoring online course materials and providing technical support to

students. The complexity of developing content and delivery tools created increased time pressure on the teachers. While teachers' attitudes were mostly positive, they experienced frustration between the vision of what online education could be and what it actually is, the reliability of technology and bandwidth issues. Muirhead notes that all participants "viewed technology as a tool to enhance student learning rather than a panacea for the challenges of education" (p. 9).

Olson, S., & Werhan, C. (2005). Teacher preparation via online learning: A growing alternative for many. *Action in Teacher Education*, 27(3), 76-84.

This article focuses on the alternative credentialing and in-service teacher professional development via online learning. Olson & Werhan (2005) note that while online courses "require similar amounts of reading, research and work as traditional [face-to-face] courses…. online courses demand more time management and self-motivation" (p. 77). They note that "today's K-12 student may actually be more Internet literate than his or her teacher" (p. 80) and that preservice teacher education delivered online would help to develop teachers' capacity with technology. They conclude by saying that "The idea of multiple pathways to teaching will continue to grow, particularly in the hard-to-staff areas of the country" (p. 81).

Ravenna, G., Foster, C., & Bishop, C. (2012). Increasing student interaction online: A review of the literature in teacher education programs. *Journal of Technology and Teacher Education, 20(2)*, 177-203.

This literature review surveyed articles on the topic of online interaction in teacher education programs between 1989 and 2010. The three types of interaction considered were student-to-content interaction, student-to-student and student-to-instructor interactions. They found that in terms of discussion board postings, "the quality of the response was a strong predictor of the quality of overall work in the course" (p. 188). They remarked that "preservice teachers would benefit from the use of online discussions as places to develop knowledge and clarify understanding through social discourse" (p. 189).

In terms of student-to-instructor interaction, Ravenna, Foster and Bishop found that instructor modeling of responses and high levels of interaction with student proved to be the most successful.

Finally, with regards to student-to-student interaction, it was found small group discussions and student-led discussion groups proved very successful (p. 195).

Rowley, J., & O'Dea, J. (2014). Enjoyment of elearning among teacher education students in Australia. *International Research in Education, 2*(1).

This study investigated student teachers' enjoyment and perceptions of elearning and how various e-learning activities (especially the discussion board) enhanced their perceptions. Results found that both broad and deep learning were enhanced; interaction with peers was facilitated; that students could learn at their own pace and had 24/7 access to learning and that students appreciated having an online space to find tips, advice and assistance.

Thornton, H. (2013). Middle level professors' perspectives regarding online teacher education. *Middle School Journal, 44*(4), 30-39.

This study investigated the views of middle grades teacher in an online teacher education program. Fifty-three (n=53) students participated in a survey to assess their views and perceptions. Results found that "although a multitude of effective, engaging teaching practices are available to online instructors, it remains to be seen whether an online course can enact the constructivist philosophy that undergirds the conceptual frameworks of most colleges of education" (p. 31) and that "the majority of respondents reported that online courses do not provide middle grades teacher candidates with practice in the social interactions necessary for being an effective teacher of young adolescents" (p. 32).

Respondents were not convinced that they could build effective teacher-student relationships online. Findings indicated that embedding face-to-face interactions in the teacher education program may prove useful, as would modeling of successful relationships in an online environment. The authors concluded that "The need for face-to-face clinical field experiences in schools with real middle grades students remains a critical companion to online teacher preparation, especially at the undergraduate level" (p. 36).

III. Pre-service Teacher Preparation Programs Delivered in a Blended Format

This section reviews literature that focused on teacher education programs and individual courses delivered in a blended format. Duhaney notes that "blended learning is considered to be any combination of methods, strategies, or modes used for teaching and learning" (p. 197). Articles addressing a variety of approaches to blended learning were reviewed.

- Blended teacher education programs are not simply a stepping-stone to fully online programs, but are a valid alternative method of delivering pre-service teacher education in their own right. It is important to note that teacher education programs differ from other kinds of professional education programs because of the necessary elements such as field experiences and student teaching. These elements must be carefully considered when developing a blended teacher education program.
- A blended approach to field experience might include having face-to-face classroom experience, combined with online reflections and discussions with peers and instructors.
- Preservice teachers trained in a blended program may develop a greater sense of community and have fewer feeling of isolation than those who take their teacher education in a fully online environment. Leaving discussion boards open to students after their courses end is one way for new alumni to continue cultivating a sense of professional community with their peers.
- Technology must be incorporated with a sense of intentionality and purpose in a blended pre-service teacher education program. It is important for pre-service teachers to explicitly understand how and why technology is being integrated into their training and that using technology for its own sake is neither useful, nor helpful. Technology must be relevant to a teacher's professional context.
- Instructors must make preservice teachers aware that the online component of their program may require a significant investment of time. Simply because a program is partly online does not mean that it will require less time or effort. On the contrary, time management is a key element to success in online and blended learning.

Allen, I. E., Seaman, J., & Garrett, R. (2007). Blending in: The extent and promise of blended education in the United States. Available from http://onlinelearningconsortium.org/publications/survey/blended06

This study surveyed over 1000 post-secondary institutions in the U.S. and an additional 2,022 U.S. adults. The survey found that as of 2007, online students were mostly undergraduates, but online studies are expected to grow significantly. Offering online and blended programs is critical to many institution's long-term strategies. Blended courses are not viewed simply as a stepping stone to fully online programs, but an alternative delivery method in their own right (p. 3). These percentages represent a variety of different types of programs and there is no single model for blended learning. It is worth noting that "a blended program can be created by blending each course in the program, by mixing face-to-face courses with fully online courses, or by some combination of the two approaches" (p. 11).

In blended courses, 30% to 79% of content might be delivered online, with the remainder being offered face-to-face (p. 5). It was found, however, that in undergraduate-level courses, there was often more online content than in graduate programs (p. 7).

The study found that in Fall 2003, 16.2% of education faculties in the United States offered online programs and 23.7% offered a blended program (p. 24).

Bliuc, A.-M., Casey, G., Bachfischer, A., Goodyear, P., & Ellis, R. A. (2012). Blended learning in vocational education: teachers' conceptions of blended learning and their approaches to teaching and design. *The Australian Educational Researcher, 39*(2), 237-257.

The researchers surveyed 81 teachers regarding their experience with and perception of blended learning for vocational education. Teachers' responses were content analyzed using a phenomenographic approach. Responses revealed wide variety of perceptions including empowering students to be lifelong learners and to delivery using technological tools. There was no consensus among participants about what their perceptions of what blended learning is or should be. Participants had qualitatively different perceptions to blended learning, as well as to methods used to teach and design blended learning. The findings suggest that teachers who focus on learner-

centred approach in classroom teaching might also take a similar approach to blended learning. A key result of the study was that there is a need to guide teachers to take a learner-centred approach, rather than focusing on the technicalities and practicalities of blended learning.

Černá, M. (2009). Blended learning experience in teacher education: the trainees´ perspective. *Acta Didactica Napocensia, 2*(1), 37-48.

This study investigated pre-service teachers' perspective of blended learning English language teacher education at the University of Perdubice, Czech Republic. Participants (n=47) were surveyed using a questionnaire. Positive aspects of blended learning identified by participants included opportunity for reflection and the "collaborative construction of knowledge anywhere anytime" (45). Negative aspects included the length of time required and having a compulsory number of postings each week.

Duhaney, D. C. (2012). Blended learning and teacher preparation programs. International *Journal of Instructional Media*, 39(3), 197-203.

This paper reviews blended learning and some of the ways it can be used in teacher preparation programs. Duhaney notes that "blended learning is considered to be any combination of methods, strategies, or modes used for teaching and learning" (p. 197). Duhaney argues that we must change "how we prepare teachers to use technology to facilitate teaching and learning among students, many of whom are already adept at using a variety of technologies" (p. 199) and that one path to this is to engage pre-service teachers more actively in blended and online learning themselves.

Duhaney suggests that some of the hours in traditional field experience might be shifted to a technology mode where teachers can use video conferencing to observe classes (p. 200) and thus reduce the number of hours they need to spend at a school site for their field experience, suggesting that partnerships between schools (or school districts) and universities might be one way to facilitate this shift towards more technologically enhanced field experiences.

Gao, P. (2010). *Enhance preservice teacher learning in the cohort structured blended learning environments.* Paper presented at the 2010 2nd International Conference on Education Technology and Computer (ICETC), Shanghai.

This study examined a cohort-based blended learning in a four-year pre-service teacher education program in the United States. Gao reports that the program offered on-site practicums, but that students engaged in reflection in an online practicum seminar called "The Dialogue Project" (p. 242). The cohort students (n=34) participated in both surveys and interviews in this mixed-methods study.

It is noteworthy that cohort students were excited to learn that their online dialogue space would remain open after their program ended, so they could continue to use dialogue virtually in their first year of professional practice (p. 243). This created a sense of sustainability for the cohort as an online learning community. Gao notes that "the participants developed a shared experience by seeking support and spreading best practices through working productively and professionally as members of their cohort structured learning environment" (p. 244).

Recommendations included leaving discussion boards accessible to students after the end-date of their program to continue strengthening collaboration; requiring students to use a variety of technologies during their pre-service programs to build their own capacity; and finally that institutions should continue to support and encourage students to share their expertise and experiences in a supportive network after graduation (p. 244).

Kang, J.-J., & Keengwe, J. (2012). Blended learning in teacher preparation programs: a literature review. *International Journal of Information and Communication Technology Education, 8*(2), 81-93.

Kang & Keengwe (2012) conducted a review of the literature on blended teacher education programs. They found that teacher education programs have features that differ from other higher education programs such as field experiences, student teaching, etc. (p. 84) and that this makes their approach to blended learning unique as well. They noted that "blended learning needs to construct and sustain an online community" (p. 85) and that "an online community should not only emphasize collaborative work, but also preserve individual learning features, such as their private learning and personal learning styles" (p. 85).

A key finding was that technology must not be used for its own sake, as the result may be that students are resentful and view the use of the technology as "busy work" (p. 87).

Instructors must use technology purposefully and help pre-service teachers understand why they are using it and how it is relevant to their professional context.

Face-to-face sessions can motivate and build connections between the students (p.89). Kang & Keengwe (2012) point out that "blended learning is not just adding face-to-face learning activities to online learning. Blended learning in [teacher preparation programs] should challenge and engage online learning activities to complement face-to-face activities in ways that are different from other higher education programs" (p. 89).

Kalelioğlu, F., & Altun, S. (2012). Experiences of pre-service teachers in case based discussion groups in blended learning environment. *Turkish Online Journal of Qualitative Inquiry, 3*(3), 15-32.

In this study, qualitative data were collected from pre-service female teachers (n=14) to gather their perspectives on blended teacher education. The program consisted of face-to-face sessions that covered the theory and online case discussions helped students to apply the theory they learned in class. The study divided students into small discussion groups, each of whom took a different approach. One group used an open approach; one used a prompted approach and the third group was led through a structured discussion.

Issues included students misunderstanding or misinterpreting each other's postings; inability to tolerate criticism and going off the assigned topic (p. 12). Technical problems resulted in frustration and time management was also a factor (p. 29). Benefits included being able to read about different solutions to a case (p. 26). Recommendations included having students co-create their own discussion rules; self-selecting for small group discussions; having no discussions during exam weeks; having an explanation at the beginning of the course as to what the discussion board is; and showing respect for one another's opinions (p. 27).

Kalelioğlu & Altun (2012) point out that "developing students' higher order thinking skills in [an] online environment took time" (p. 30) and that students resisted engaging in the discussion board because of the time it took.

A key recommendation is that instructors should make students aware of the time commitment and also what the expected outcomes are for participating (p. 30).

Marshall Arnold, J., & Collopy, R. M. B. (2009). To blend or not to blend: online and blended learning environments in undergraduate teacher education. *Issues in Teacher Education, 18*(2).

In this study the researchers investigated the perceptions of undergraduate education students (n=80) who received the same curriculum through different models: blended and online formats. Students in the blended group reported higher levels of perceived learning than those in the group who learned entirely online (p. 96). Similarly, those who worked entirely online felt more isolated and alone (p. 96). Participants in the blended group also reported a more positive experience with group learning projects (p. 98). Marshall Arnold and Collopy recommend including a face-to-face component in teacher education courses instead of having an entirely online learning experience (p. 96). They also point out that it is important for faculty to be trained and supported in how to offer blended and online content in an effective manner (p. 99).

Vaughan, N. (2007). Perspectives on blended learning in higher education. *International Journal on E-learning, 6*(1), 81-94.

This article explores the perceptions of faculty, administration and students towards blended learning. Students identified positive aspects as including flexibility, but that time management is an issue in the early stages. Faculty identified flexibility and opportunities for continuous improvement as positive aspects with lack of time and support as being negative elements. Administrators perceived that blended learning enhanced the institution's reputation, but that challenges existed in terms of resistance to organizational change and lack of organizational structure to support blended programs.

Vaughan, N., & Lawrence, K. (2013). Investigating the role of mobile devices in a blended pre-service teacher education program. *Canadian Journal of Higher Education / Revue canadienne d'enseignement supérieur, 43*(3), 56-77.

This study looked at the use of tablets in a blended pre-service teacher education programs. The results showed that mobile devices may be useful for supporting collaboration and facilitating learning, but less effective for planning, assessment and classroom management. Both student participants (n=14) (all under the age of 25) and faculty (n=6) were included in the study. A notable result of the study was that students

indicated that “human contact was more important than computer-mediated communication when learning and practicing professional responsibilities such as ethical behaviour” (p. 64).

Another notable result was that perceptions towards using a tablet for learning were generally positive at the beginning of the semester, but diminished throughout the semester, with technical restrictions (e.g. unpredictable WiFi, small keyboard and small screen) being cited as reasons (p. 66)

IV. Technology-focused Pre-service Teacher Preparation in Rural and Remote Communities

This section focuses on literature that specifically addresses teacher education programs in rural and remote communities that use technology as a key element of their programs.

- Student computer access remains a significant challenge in rural and remote areas. Barriers to effectively integrating technology into rural and remotes schools include having adequate connectivity (bandwidth); lack of technical support in schools and lack of training and professional development for teachers.
- Enhancing the technology literacy of rural and remote teachers is essential for them in order to develop the competence and confidence to successfully integrate technology into their teaching practice.
- Even when rural and remote teachers demonstrate positive attitudes towards using technology for learning, providing them with support is essential to help them integrate it into their professional practice.

Alberta Education. (2012). *Promising practices in rural elementary education: Final report*. Retrieved from http://education.alberta.ca/admin/technology/research.aspx.

This study found that there are differences not only between rural and urban education in Alberta, but also differences among rural regions themselves (p. 4). Just as cities are different in their demographics, needs and strengths, so too are rural communities. This study explored promising practices from case studies from four different rural Alberta contexts.

Citing from previous works, the study offered this definition of "rural" for the Alberta context:

"Rural can refer to towns and municipalities outside the commuting zone of larger urban centres with populations of 10,000 or more (du Plessis, Beshiri, Bollman and Clemenson, 2001). Rural communities can be also defined as countryside, rural, remote and northern communities depending on their distance from the urban centres (Malenfant, Milan, Charron & Bélanger, 2007) (p. 6)".

The report points out that even as of 2011, student computer access remains a challenge in many rural school authorities in Alberta (p. 10). There are a number of barriers to integrating technology into rural schools that include, but are not limited to connectivity (bandwidth) issues; lack of access to PD for teachers and lack of technical support.

The report also discussed how staffing issues can create a barrier to long-term success for rural schools. One strategy that has successfully reduced turnover is to hire teachers from the local community (p. 11)

Howley, A., Wood, L., & Hough, B. (2011). Rural elementary school teachers' technology integration. *Journal of Research in Rural Education, 26*(9). Retrieved from http://jrre.psu.edu/articles/26-9.pdf

This study surveyed over 514 third-grade teachers on questions relating to technology integration and its impact in rural elementary schools. Results showed that rural teachers continue to have limited access to instructional technology and their preparation to integrate technology has been inadequate to support student learning.

Despite this, rural teachers reported more favorable attitudes towards technology in comparison to their urban counterparts. Howley, Wood & Hough note that, "teacher attitudes toward technology influence not only the extent to which they integrate technology into instruction, but also the attitudes of their students toward using technology as a tool for learning" (p. 7). Cultivating teachers' positive attitude and competence is a key factor in the probability they will use technology in their classes, but "the study did, however, suggest that a predictable set of supports might still be needed in order to help rural teachers integrate technology in ways that promote the sophisticated engagement of their students" (p. 7).

Northern Alberta Development Council. (2010). Rural and Remote Education Report. Available from www.nadc.gov.ab.ca/Docs/rural-remote-education.pdf

This report focuses specifically on issues affecting education in rural and remote areas of Northern Alberta. The report notes that "in order for northern small schools to remain viable and continue to deliver high quality education opportunities, they will need to adapt" (p. 1). This includes incorporating more technology and to achieve that goal, bolstering the technology literacy of educators who work in these areas is a key objective. Effective use of technology by those who currently work in rural and remote schools was identified as a major barrier to technology use by students (p. 7). It was noted that "For technology to work in the classroom, teachers must become efficient, but not reliant on, new methods to improve instruction" (p. 7).

Another major issue is the current availability of bandwidth (p. 6). All divisions expressed an urgent and immediate need for increased bandwidth, which would represent an increase in cost to schools (p. 7).

The report states that northern rural and remote schools in Alberta "struggle to recruit and retain qualified staff" (p. 3). An increased focus on recruiting local teachers was considered a priority, with the idea of "growing our own teachers" (p. 11) posed as a possible solution. This approach, promoted by Farrell & Hartwell (2008) involves recruiting teachers locally to meet teaching demands (p. 19).

The report specifically calls on Alberta's universities to incorporate rural learning and experiences into their Education curricula ("similar to medical student rural clerkships") (p. 20) and also calls for increased post-secondary training and recruitment of special needs teachers (p. 21).

Stevens, K. (2013). Technology Mediated Learning to Sustain Rural Schools: Personal Reflections on an e-Learning Project. Available from www.mun.ca/educ/faculty/mwatch/vol41/fall2013/kenStevens.pdf

In this project Stevens outlines his experience with the Vista project, which aimed to develop K-12 distance education in Newfoundland and Labrador through the government's creation of the Centre for Distance Learning and Innovation (CDLI). Eight schools were administratively and academically linked through the program. Stevens notes that teachers who participated in the project had been appointed to traditional schools (p. 4), but also participating in the project, which allowed schools to collaborate via asynchronous and synchronous learning. Courses included Advanced Placement (AP) courses in science and mathematics, which made these courses available to rural students for the first time.

Winstead Fry, S. (2006). A technology supported induction network for rural student teachers. Retrieved from http://www.ruralteachers.com/wp-content/uploads/2011/03/a-technology-supported-induction-netwrok-for-rural-student-teachers.pdf

In this article, Winstead Fry (2006) discusses a qualitative case study of the Technology Supported Induction Network (TSIN) in Wyoming, U.S.A., which was developed to address the lack of support available to pre-service (n=15) teachers with rural placements. The results of the case study showed that the two primary forms of support offered by the TSIN included a discussion board and synchronous compressed video sessions offered support to pre-service teachers (p. 1). Telephone and e-mail were used as secondary supports (p. 3).

Findings revealed that the discussion board was an ineffective means of support, with only 4 out of 15 student teachers using the discussion board more than four times (p. 4). Twelve teachers attended one or more of the compressed video sessions, which "allowed participants to bridge geography and have virtual face-to-face conversations in real time" (p. 5). Winstead Fry determined that "the personal communication time at the end of the compressed video sessions helped the student teachers to maintain social connections with their peers" (p. 6). The results showed that those who were most active with the TSIN received the most benefit from it (p. 7), though lack of participation was a concern. It was noted that the TSIN was not intended to replace

visits from the university placement officer, but rather as a supplement to it (p. 7) and one-on-one feedback is still a critical piece of a student teacher's development.

Weitzenkamp, D. J., Howe, M. E., Steckelberg, A. L., & Radcliffe, R. (2003). The GOALS model: Rural teacher preparation institutions meeting the ideals of a PDS through educational technology. *Contemporary Issues in Technology and Teacher Education, 2*(4). Retrieved from http://www.citejournal.org/vol2/iss4/currentpractice/article1.cfm

In this study Weitzenkamp, Howe and Steckelberg examine the implementation of professional development schools (PDS) in rural areas of the United States. The GOALS model "is designed to capitalize on field experiences and to initiate and reinforce the professional development of the individual teacher candidates through observation and collaboration with diverse master teachers" (p. 579). In this project, observation of practicum students was conducted via distance through interactive television (ITV). In addition, the participants (n-22) kept journals to track their practicum experience.

A significant barrier in this study was moving the class to the lab where the ITV technology was available for the session (p. 587).

V. Critical Perspectives of Technology for Learning

This section addresses what critics say about online and blended teacher education programs. Understanding this side of the debate is critical to overcoming both real and perceived barriers to success for students enrolled in technology-driven programs.

- Critics are skeptical that teacher education can be effectively delivered in any format other than face-to-face instruction.
- Administrator perceptions of online preservice teacher education are more negative than positive. In particular, there is concern that the social aspects of teaching may be compromised when delivered in an online or blended format. As a result, administrators in charge of hiring may be reluctant to hire students graduating from online or blended programs.
- Lack of support from institutional administration can be a significant barrier to developing or investing in resources or programs requiring technology. This may be because such decisions are perceived to be made according to the beliefs of those who support technology, rather than substantive evidence of the effectiveness of technology for learning.
- Drawbacks of online and blended preservice teacher education include excessive demands on the time of both those enrolled and those teaching in the program. Beliefs about how difficult technology may be to use also played a key barrier to integrating technology into learning.
- The amount or availability of technology does not seem to matter as much as its reliability. When resources do not work or require troubleshooting, or the steps to set up the technology are cumbersome, technology becomes a burden rather than an asset. When that happens, teachers may abandon technology in favour of tried and true traditional resources that can be used at a moment's notice.

de Carvalho Borba, M., & Llinares, S. (2012). Online mathematics teacher education: overview of an emergent field of research. *ZDM Mathematics Education, 44*, 697-704. Retrieved from http://download.springer.com/static/pdf/217/art%253A10.1007%252Fs11858-012-0457-3.pdf?auth66=1411676223_1d80f7e69741dfd8f35db8bb22076a02&ext=.pdf

De Carvalho Borba & Llinares note that, "a course that uses asynchronous discussions or e-mail as the primary interactional environment produces a fundamentally different learning environment and experience for students than a course taught mainly with video-conferences" (p. 698). They note that there has been a rise in collaboration among teachers, "Online collaboration among teachers in professional development programs has emerged as a context that favors the process of sharing and discussion among teachers with different degrees of expertise" (p. 698), but question the impact of collaborative learning in asynchronous environments (p. 700).

Ultimately De Carvalho Borba & Llinares note that there remains strong debate about whether the online learning environment is "just another setting" (p. 701) and that the online environments "profoundly affect" how learning is achieved. They point out that, "It is not clear what factors and how online communities keep being a ''place'' where learning and teaching takes place" (p. 703).

Faulk, N. (2010). Online teacher education: What are the results? *Contemporary Issues in Education Research, 3*(11), 21-28.

Faulk surveyed school superintendents (n=48) and principals (n=88) in Louisiana, U.S.A. about their perceptions of online teacher preparation programs. The results showed that administrator perceptions of online preservice teacher education were much more negative than positive. While administrators felt that online education might be appropriate for theoretical aspects of teaching and learning, their perceptions were negative in terms of teaching classroom management, student diversity and special needs.

A large majority of administrators (87% of superintendents and 89% of principals) had moderate to strong reservations about hiring teachers who had been primarily trained

online. Faulk comments that, "This rapid growth in online teacher education does not bode well for the future teacher candidates" (p. 23).

Huss, J. A. (2007). A tri-state study: Administrator attitudes toward online teacher preparation programs: Are principals logging on—or logging off? *IEJLL: International Electronic Journal for Leadership in Learning*, 11. Retrieved from http://iejll.synergiesprairies.ca/iejll/index.php/ijll/article/view/659.

This study surveyed school principals in the U.S. mid-west (n=326) about their perceptions of the legitimacy of online teacher preparation programs. Principals expressed apprehension about the social aspects of teacher education being compromised, with 95% stating that they did not believe that an online teaching degree carried as much credibility as a traditional classroom program (p. 4). Huss concluded that "if principals are to ultimately acknowledge the legitimacy of online teacher preparation, the degree-granting institutions must address these concerns and actively seek input of administrators in program design" (p. 1).

Kang, J. J. (2014). Learning to teach a blended course in a teacher preparation program. *Contemporary Issues in Technology and Teacher Education, 14*(1).

This case study details the experience of one instructor in a blended teacher education program. Kang notes that the instructor "saw herself taking on additional roles in the blended environment" (p. 54). Building on Berge's (1995) of the four roles of the instructor into pedagogical, social, managerial and technical, Kang notes that instructor roles in a blended course may expand to include elements such as course design and ongoing modification to meet learners' needs, as well as the implementation of technology tools.

One result of the study was the recommendation that online and face-to-face activities be integrated without disconnection (p. 62) and instructors should be familiar with the program as a whole, not just their assigned course.

Drawbacks of a blended course from the instructor perspective include "too much time and effort" (p. 66), "struggling with connecting both online and face-to-face activities" (p. 66), how to evaluate students' learning activities and the limitations of technology (p. 66).

Kopcha, T. J. (2012). Teachers' perceptions of the barriers to technology integration and practices with technology under situated professional development. *Computers & Education, 59*(4), 1109-1121.

Kopcha investigates teachers' perceptions of the barriers to integrating technology into their teaching practice. He notes five key barriers for teachers (p. 1109):

- Access – Lack of access to technology or when it is available it does not work properly.
- Vision – Only teachers with a strong administrative vision for how to use technology are less likely to abandon technology when they encounter setbacks.
- Beliefs – A teacher's belief about the usefulness of technology and the difficulty in using it influence the likelihood they will use it.
- Time – Teachers report that integrating technology takes more time than learning without technology.
- Professional Development – Teachers identify lack of adequate training as a barrier to integrating technology.

In their study which situated professional development for teachers (n=18) within their own school they found that, "while there was a tremendous amount of technology available to teachers, most of the resources did not work, needed troubleshooting, or needed to be set up for teacher and student use. In addition, teachers were concerned that using technology throughout the day would be an interruption in their instructional time" (p. 1112). In addition to observation, a questionnaire and interviews were also used to gather data.

Teachers reported that time was their biggest challenge when using technology for instruction and also integrating technology into lesson planning (p. 1116). Even with increased training and mentoring, teachers' negative perceptions persisted, with regards to the amount of time required to integrate technology into their practice (p. 1118), noting that, "Teachers often perceive technology as a burden on their time because it interrupts instruction, requires additional training, and takes time to plan" (p. 1118). In conclusion Kopcha asserts that individual mentoring can provide teachers with much-needed support to integrate technology into their practice (p. 11120).

Miller, P. S., & Stayton, V. D. (1993). Blended interdisciplinary teacher preparation in early education and intervention: A national study. *Topics in Early Childhood Special Education, 18*(1), 49-58.

This article focused specifically on blended teacher education for special education. Participants (n=49) were surveyed for their opinions on blended learning. Participants reported experiencing "considerable frustration and concern" (p. 55). The results showed that "administrative and interpersonal issues emerged as primary barriers to effectiveness" (p. 56). There were also concerns that content was "watered down" in when transferred to an online environment and that program quality suffered (p. 56).

Lack of support from administration was identified as a key barrier to success. Recommendations included having "concrete plans of support" for faculty (p. 56).

Finally, the study revealed that the decision to adopt blended learning was grounded in beliefs rather than research (p. 57) and that more research is necessary to determine the effectiveness of such programs.

Rienties, B., Brouwer, N., & Lygo-Baker, S. (2013). The effects of online professional development on higher education teachers' beliefs and intentions towards learning facilitation and technology. *Teaching and Teacher Education, 29*, 122-131.

In this study 73 academics from 9 higher education institutions followed an online teacher development program. A questionnaire was administered to determine pre- and post- perceptions. TPACK was used as the framework used for the study. Findings indicated that, "after twelve weeks of training participants were more confident in their ability to integrate technology within their pedagogical design and discipline and were putting this into practice" (p. 129).

Rientes, Brouwer and Lygo-Baker (2013) found that "In contrast to [their] initial expectations, the professional training program did not lead to a change in teachers' beliefs and intentions towards more student-centred learning. Significant differences were found with respect to lower intentions towards knowledge transmission, indicating that participants were less convinced about the appropriateness of such a teaching style and wanted to redesign their module away from teacher-centred learning" (p. 129). While teachers' confidence and experience increased, there was no

evidence to support that PD delivered in an online format was likely to make them more student-centred in their practice.

Kim, C., Kim, M. K., Lee, C., Spector, J. M., & DeMeester, K. (2013). Teacher beliefs and technology integration. *Teaching and Teacher Education, 29*, 76-85.

Kim, Kim, Lee, Spector & DeMeester (2013) conducted a study with 22 U.S. teachers engaged in a 4-year professional development project. The objective of the project was "to improve the use of technology in poorly performing rural K-8 schools in the Southeast" (United States) (p. 78). Data collection included a questionnaire, observations and interviews.

Findings revealed that, "teachers' beliefs about the nature of knowledge and learning and beliefs about effective ways of teaching were related to their technology integration practices" (p. 82), suggesting that "teacher beliefs should be considered in order to facilitate technology integration. Especially, teacher beliefs about the nature of knowledge and learning that influence their beliefs about effective ways of teaching should be further studied since those fundamental beliefs can be a starting point to overcome the second-order barriers to technology integration" (p. 82).

Kim, Kim, Lee, Spector & DeMeester (2013) note that delivering professional development with the intention of changing teacher beliefs may pose some ethical questions, but these may be not be a significant concern when the objective to be achieved is student learning.

VI. Monitoring, Evaluating and Assuring the Quality of e-Learning and Blended Learning Programs for Teacher Education

This final section of the report addresses quality assurance issues around online and blended learning programs for teacher education. Understanding how questions of quality are addressed will help us in both our program design and evaluation.

- Program evaluation has traditionally focused on how processes and systems lead to desired outcomes. In education, such outcomes are often not valid indicators of success.
- The evaluation of online and blended education programs often focus on the effectiveness of the technology, rather than the learning.
- The evaluation of pre-service blended and online teacher education seems to be in its infancy and effective methods have yet to be developed to adequately assess the effectiveness of how well such programs prepare teacher for their future professional practice.

Abbitt, J. (2011). Measuring technological pedagogical content knowledge in preservice teacher education: A Review of Current Methods and Instruments. *Journal of Research on Technology in Education, 43*(4), 281-300. Retrieved from www.dlc-ubc.ca/wordpress_dlc_mu/educ500/files/2011/06/abbitt.pdf

This article provides a literature review of instruments and methods used to evaluate pre-service teacher preparation programs, focusing on Mishra & Koehler's TPACK framework. Abbitt reviewed 91 articles focused on using the TPACK model. Abbitt concluded that "much remains to be learned concerning the knowledge base that teachers require to create learning environments where they can use technology in productive and meaningful ways to support student learning" (p. 295) and that "gaps undoubtedly exist in the available instruments and methods" (p. 295).

Ellis, R. A., & Calvo, R. A. (2007). Minimum indicators to assure quality of LMS-supported blended learning. *Minimum Indicators to Assure Quality of LMS-supported Blended Learning, 10*(2), 60-70.

This study describes a number of institutional indicators of minimum quality standards for learning that is supported by a learning management system (LMS) in a blended environment. Seven (7) universities who use the same LMS are compared using a qualitative questionnaire. Results reveal that while the technical merits of the LMS may be easily identified, educational issues are less easily identified. Ellis & Calvo (2007) note that outcomes-based measures such as the quantity of employed graduates at a given point in time are "insufficiently descriptive to indicate how they developed their attributes sufficiently to make them employable. One of the shortcomings of using only outcomes-based indicators for quality assurance is that they are often not very useful for improving the (often complex) processes that lead to desirable outcomes" (p. 61)

Foulger, T. S., Wetzel, K., Buss, R. R., & Lindsey, L. (2012). *Preservice teacher education: Benchmarking a stand-alone ed tech course in preparation for change.* Paper presented at the ISTE 2012, San Diego, CA.

In this study Foulger, Wetzel, Buss & Lindsey conducted a benchmarking study of a stand-alone technology course in a pre-service teacher education program for the purposes of determining best practices that could be incorporated into a new program design. In the new program design, technology would be infused into a group of content methods courses in order to eliminate the standalone course, thus reducing costs to the faculty. Participants included 110 students from the stand-alone course who completed both a pre- and post-test questionnaire. Results revealed that pre-service teachers' confidence and comfort levels increased significantly during the stand-alone course. Despite that, student felt only "moderately prepared to teach with technology" (p. 17).

Best practices revealed during the study included giving students hands-on access to use the technology themselves; accommodation of different learning styles; exposure to many readily available tools (p. 18). As the study dealt with a pre-design phase of the program renovation, no evidence was available to establish how students progressed with technology being embedded in content methodology courses.

Varlamis, I., & Apostolakis, I. (2010). A framework for the quality assurance of blended e-Learning communities. In R. Goebel, J. Siekmann & W. Wahlster (Eds.), *Knowledge-Based and Intelligent Information and Engineering Systems* (Vol. 6278, pp. 23-32).

Varlamis & Apostolakis (2010) note that a traditional approach to quality assurance is to evaluate the system and processes to ensure they achieve the expected outcomes (p. 23). In this study, they evaluate the processes within an e-learning environment. Varlamis & Apostolakis (2010) identify they critical elements of e-learning and blended learning programs: pedagogical, technical and social, but noted that they had not encountered any approaches to evaluating e-learning or blended learning that managed to assess all three key components of a program (p. 24). Their study proposes an evaluation framework that might be used to address all three areas of e-learning and blended learning. The authors offer a number of criteria to use when evaluating such programs. Each criterion can be assigned a numerical value in order to end up with a quantitative result. The authors suggest in their conclusion that their "general evaluation framework" may be superior to more "inflexible evaluation schema", but without examples of how they themselves have implemented the framework in their own work.

Conclusion

Each of the six (6) sections of this report has summarized research findings that can inform educators, policy makers and others interested in the topic of online and blended preservice teacher education, particularly for those living in rural and remote communities. The research team concludes that online and blended pre-service teacher education programs offer a positive and viable alternative to those living in rural and remote areas, without the candidates being required to leave their communities in order to receive training.

Quality blended instruction in teacher education programs holds the potential to provide equity and access to rural and remote Bachelor of Education students. In addition. Preservice teachers trained through online or blended instruction may be better positioned to prepare their future students to effectively use technology for learning, regardless of whether that learning happens in a traditional classroom or a virtual school.

The debate around whether equity and access for rural pre-service teachers can be addressed through meaningful and effective online and blended environments hinges on how such programs can best be designed to address the needs of pre-service teachers and educational stakeholders, such as administrators who hire teachers for rural and remote areas.

We hope that the literature we have summarized will be helpful to educators, school authorities, scholars and others interested in this timely and relevant topic.

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