Video-conferencing in rural and remote secondary education in Canada:

A mixed-method collective case study of teachers’ perceptions around

presence, process and professional learning

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School of Education
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Author’s Declaration

I declare that this dissertation is my own account of my research and contains as its main content work which has not previously been submitted for a degree at any tertiary institution.

Nicole A. Rehn
Abstract

Videoconferencing technology offers an enticing opportunity for distance education providers to optimize the sharing of human resources by connecting geographically distributed teachers and students through real-time, two-way video. The purpose of this research is to investigate the experiences of eight teachers and their rural secondary students in courses that are delivered synchronously by videoconference. The study specifically examined teacher presence across a screen, the navigation of challenges and affordances of the medium, and the unique teaching skills and roles required. This collective case study research used a mixed methods approach to follow these three lines of inquiry in order to provide a comprehensive picture of the experience of teaching by videoconference in rural Alberta. The following key findings were reported: there are obstacles to developing presence implicit in the context such as insufficient time, isolation, scheduling and logistics, unreliable technology, and limited personal connection. Teachers’ confidence and experience, the use of immediacy behaviours, and understanding student learning presence can mitigate some of those obstacles. Furthermore, by leveraging supporting communication tools, intentionally building presence and prioritizing the programming within the district the affordances of the context were maximized. Teachers who felt unprepared and untrained for the various unique skills required to teach successfully by videoconference suggested that the development of standards, professional collaboration, and action research would better support their roles. These findings confirm many of the issues raised in a largely undeveloped body of literature and also contribute new perspectives on technological integration, teacher presence, and video conferencing for distance education. Implications for best practice, teacher training and further research are provided.
Acknowledgements

First and foremost I want to express gratitude to my supervisors Dr. Dorit Maor and Associate Professor Andrew McConney who have provided guidance and support throughout this research process, often from afar. I have enjoyed the courses you led and the research advice you provided. You taught me patience and good methodology. Thank you to the Australian Government for funding this research through the Australian Postgraduate Award, which allowed me to drive thousands of kilometers to meet with teachers who are scattered all over this province.

I want to acknowledge the eight teachers in this study who passionately strive to meet the learning needs of our rural and remote students in this province, and who gave up their precious time to participate in this research. They always welcomed me into their classrooms, their small rural towns and their experience of teaching by videoconference. I also appreciate the support of the administrators of each school division who connected me with the participants and gave their approval for the study.

Lastly, I would like to thank my partner, John Markez, for his love and encouragement during these last six years. During the regular times of discouragement, he always reminded me to just return to my computer and keep writing.
List of Publications

Paper 1


Paper 2


Paper 3

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CHAPTER 1 - INTRODUCTION

1.1 Background to the study

Distance education is continuously impacted by rapid advances in technology (Abas, 2015; Staker, 2011). In particular, synchronous communicative technologies, such as videoconferencing platforms, are bringing dispersed teachers and students together across great distances to create real-time interactive classrooms where print-based correspondence courses once dominated. These emerging synchronous tools have the potential to drive paradigm change in teaching and learning across a distance, particularly with ways they support interaction, and the trend toward “high school redesign”, or “flexible programming”. Berge and Collins (1995) predicted this shift many years ago when they suggested that “the networked computer has the potential to be an agent of socialization, collaboration and social learning” (p. 6).

A few years ago, while working at a large urban high school, I was recruited to teach a pre-calculus course to a group of students that were located at a small rural school 150 km away. This was accomplished with videoconferencing technology and an online Learning Management System (LMS). The videoconferencing suite was set up in my regular math class in the city so that I could simultaneously teach the students who studied face-to-face and those who were located remotely. The teaching assignment was challenging as I feebly tried to apply the teaching strategies with which I was familiar to this new situation. Establishing rapport with students, managing classroom behaviour, administering the course through the LMS, designing meaningful learning activities, and instructing in this setting were difficult. I had to form relationships with students on the other side of a screen, portray my passion and enthusiasm for learning without actually being there, foster collaboration between my “real” and “virtual” students, distribute resources electronically, and teach across a screen while simultaneously teaching students in the physical classroom.
The school district provided support for this project, but this was limited to technological assistance that pertained to hardware and software. When I asked for pedagogical resources, ideas, and research I was left empty-handed. In fact, there are very few published research studies on K-12 videoconferencing (Lawson, Comber, Gage & Cullum-Hanshaw, 2010). In order to better meet the learning needs of this population of students and to support the teachers who find themselves on one side of a videoconference screen, I left the classroom to pursue formal study of this teaching context. This thesis represents the culmination of this study and intends to provide a theoretically and practically meaningful contribution to the body of research on videoconferencing in K-12 distance education. This will be significant for school jurisdictions with dispersed student populations that lack human resources and course offerings in rural Canada, rural and remote Australia, and elsewhere.

Videoconferencing for course delivery pervades schools in rural and remote Alberta, Canada (Government of Alberta, 2010). Nineteen percent of Albertans live in rural areas that are dispersed over a vast geographical area of more than 650 thousand square kilometres. Education is decentralized in the province with approximately 40 school divisions servicing these widespread rural regions. Consequently, distance education is well established in Alberta. To improve opportunities and connectivity for rural and remote citizens, the government introduced a high speed SuperNet across the province in 2005. In addition, 800 videoconference suites were purchased for schools which gave rise to the introduction of videoconferencing into mainstream distance education in Alberta. Videoconferencing is also being used to deliver courses beyond Alberta, particularly for K-12 rural education. Examples of these videoconference users include the Correspondence School in New Zealand (Roberts, 2009), School of the Air in Australia (Vize, 2014); Lincoln Public Schools, Nebraska (Raths, 2015); and the Newfoundland and Labrador Department of Education (Barbour, 2015), among others. Videoconferencing has
become a mainstay in K-12 distance education due to its promise of live interaction and a context that closely resembles face-to-face teaching (Anderson, 2008). However, it has also been shown, both in research and anecdotally, that while videoconferencing expands opportunities for remote students (Lee, 2007), it is typically inferior to face-to-face teaching due to technical interruptions, transactional distance, and to the challenges associated with forming relationships between students and teachers across a distance (Doggett, 2008; Hauber, Regenbrecht, Hill & Cockburn, 2005). Thus, students remain isolated. Regardless, school divisions are forging ahead with this medium for course delivery due to its cost-effectiveness in providing widely dispersed students better access to courses. Research, however, has struggled to keep pace with the adoption of videoconferencing and teachers are left with little support, training or resources. A review on school-based videoconferencing in Alberta, Canada reported that, in response, teachers have tended to revert to familiar face-to-face pedagogies rather than exploiting the technology for the interactivity, student-centred methodologies, and innovative practices that videoconferencing potentially affords (Alberta Education, 2006).

1.2 Structure of the thesis

A thesis by publication format was chosen for this doctoral dissertation. Three standalone empirical studies were conducted over two years that cohered to a single purpose of better understanding the experience of teachers and their students in high school courses that were delivered by videoconference. This thesis gives a broad overview of the videoconferencing and distance education literature, an outline of the research methodology, and a synthesis of the findings and discussion. Three papers were produced as a result of this study and are included in the thesis. The implications for practice and further research as a result of this overall study are also provided.
1.3 Research Aims

While some claim that teaching by videoconference most closely replicates the face-to-face classroom experience (Bernard et al, 2004), anecdotal evidence by the researcher and much of the evidence provided in the research literature suggests otherwise (Doggett, 2008; Hauber, et al., 2005). With a growing number of students taking courses by videoconference (either by choice or necessity), it is important for researchers to seek understanding about this teaching context and to provide educators with knowledge of the unique dynamics that exist when teaching across a screen so that they can adapt their pedagogy accordingly. The aim of this research, therefore, is to unpack the experience of teachers and their students in high school courses delivered by videoconference in order to identify the unique skills that a teacher requires for a successful learning experience – once which has a high degree of teacher presence (referred to hereafter as presence). The research drew on one set of data but was organized into three stand-alone empirical studies that addressed the videoconference experience from three different angles: developing presence (RQ 1-4); navigating the challenges of using videoconferencing (RQ 5-6); and, identifying the skill set required for successful teaching in a videoconference environment (RQ 7-8). The research questions and aims that drove this each study are given in Table 1.
### TABLE 1: RESEARCH AIMS AND QUESTIONS

<table>
<thead>
<tr>
<th>Overall Purpose</th>
<th>Paper Title</th>
<th>Research aims addressed by paper</th>
<th>Research questions addressed by paper</th>
</tr>
</thead>
</table>
| The purpose of this research is to investigate the experiences of eight teachers and their rural secondary students in courses that are delivered synchronously by videoconference. | Paper 1: Investigating teacher presence in courses using synchronous videoconferencing | The aim was to examine the construct of presence in a course delivered by videoconference. It was grounded in the assumption that there is a relationship between reported high teacher presence, student satisfaction, and learning outcomes. | 1. How do the teachers' perception of their own technological pedagogical content knowledge and confidence as well as their experience impact presence?  
2. What do high school students expect of their VC teachers in terms of presence?  
3. What actions do videoconference teachers take to increase presence in their courses?  
4. What is the impact on presence when videoconference teachers are required to teach remote and face-to-face students simultaneously? |
| Paper 2: Navigating the challenges of delivering secondary school courses by videoconference. | Paper 2: Navigating the challenges of delivering secondary school courses by videoconference. | The aim was to understand the challenges that videoconference teachers face and uncover ways to overcome those challenges. | 5. What challenges do teachers face when teaching by videoconference?  
6. How have teachers who use videoconferencing overcome the challenges associated with this unique modality? |
| The unique skills required of videoconference teachers in high school distance education courses: Implications for training and professional development | Paper 3: The unique skills required of videoconference teachers in high school distance education courses: Implications for training and professional development | The aim was to formalize the skill set required to teach successfully in a videoconference according to role by combining qualitative data with the findings from previous studies. | 7. What unique skills do K-12 videoconference teachers require to create a successful learning environment for distance students?  
8. What are the implications of the above for teacher professional development? |
CHAPTER 2 – LITERATURE REVIEW

2.1 Literature review

The goals of this literature review are to synthesize what is already known about the use of videoconferencing for distance education course delivery, especially at the high school level, to frame the research in an appropriate conceptual framework, and to identify the instruments that have previously been used to study presence. This is not a comprehensive review of all the literature as this has been provided in each of the published papers. Rather, it is an overview of the most relevant literature. Videoconferencing is used by educators in a variety of ways: to enhance curriculum in the face-to-face classroom; to create blended learning environments at post-secondary institutions; and, to deliver entire courses synchronously to dispersed students. The focus of this research was on the latter. The following keywords were used in Google Scholar, ERIC, and ProQuest databases to find relevant studies: videoconferencing, synchronous, distance education, teaching presence. Initial reviews revealed the importance of presence as a construct in distance education and showed strong association between high levels of presence and high teacher and learner satisfaction (Hackman & Walker, 1990; Jones, Kolloff & Kolloff, 2008; Shin, 2002; Witt, Wheeless & Allen, 2007). Therefore, an exploration of teacher presence in the videoconference context and the implications for teaching became the key focus of this research.

Videoconferencing for Distance Learning

Research into videoconferencing as a mode of course delivery is underdeveloped (Lawson et al., 2010) but a small number of studies have been conducted over the last decade as the technology continues to improve and pervade distance education contexts. These studies have focused on a variety of issues including student satisfaction (Doggett, 2008; Gillies, 2008; Karal, Cebi & Turgut, 2011), student results (Giesbers, Rientes, Tempelaar & Gijselaers, 2013), program
success (Alberta Education, 2006; Anderson, 2008; Barbour, 2015; Koeber & Wright, 2008; Roberts, 2009), comparative analysis with other modalities of education delivery (Bernard, Abram, Lou, Borokhovski, Wade, Wozney et al., 2004; Furst-Bowe, 1997), and challenges and affordances associated with the technology (Fitzgibbon, 2003; Martin, 2005; Murphy & Coffin, 2003). This body of research offers an overview of the landscape of videoconferencing in regards to how it can be used as an alternative to traditional distance education and online models, as well as providing a small glimpse into the actual experience of teachers and learners in this context. The issues raised can be broadly categorized as technical (issues with hardware and software), logistical (time constraints and course management) or instructional (relationships, interactivity, pedagogies, and presence). While attention was given to all these issues in the current study, the issue of teacher presence was of particular interest because it was a perceived lack of presence by the researcher in her own practice that formed the impetus for this research.

Gillies (2008) examined student perceptions of videoconferencing in a teacher education course. Gillies acknowledged that the nature of the medium for teaching created challenges in terms of pedagogy, particularly in regards to physical separation, the lack of a shared space, and limited alternative learning contexts. Gillies’ research sought to examine both the pedagogical and social issues pertinent to videoconferencing in order to improve practice and provide a better learning experience for students. He found that, aside from improving cost and access, videoconferencing increased interactivity because the technology allowed for the projection of facial expression and body language. The perceived problems of videoconferencing included issues with technological logistics, pedagogical inflexibility, and lack of training and resources for teachers. Even though Gillies’ study closely aligns with the aims of this research, it was conducted in a post-secondary context and
for reasons outlined by Knowles (1980) in his work on adult education, K-12 warrants its own study.

Anderson (2008) reviewed the use of videoconferencing in early adopter schools in Alberta when the new high-speed digital network was installed across the province. He found that the videoconferencing technology caused various challenges when compared to face-to-face instruction, such as decreased teacher presence, inability to interact within the learning context in quite the same way, and increasing time and effort to exchange documents. However, Anderson acknowledged the benefit of being able to span geographic distance with interactivity not normally afforded in traditional print-based distance education. The study concluded by calling for more research into pedagogy when using videoconference and other online technologies, to which this study responds.

The Canadian province of Newfoundland and Labrador has been using videoconferencing and other synchronous communication technologies to support distance education for the last ten years and a few small qualitative studies have been conducted to better understand the experience of teachers in those settings. The findings, which show that videoconferencing has the potential to create learner-centred environments (Murphy & Rodriguez-Mazanares, 2009), that teachers need more professional development (Murphy & Coffin, 2003), that time is a limitation (Murphy, 2010), and that pedagogy trumps technology (Murphy, Rodriguez-Manzanars & Barbour, 2011), have all contributed to laying the foundation for the current study.

Koehler and Mishra (2009) examined the knowledge that teachers require to integrate technology effectively into education contexts in general. They proposed the Technological Pedagogical and Content Knowledge (TPACK) framework as a way to explain the content, pedagogy and technical knowledge that teachers need to be successful when using technology in the classroom. They advocate for a skill set that
sits at the intersection of these three types of knowledge, where each have a role to play both individually and together. This has implications for the videoconference teacher who needs to understand how to leverage the technology for pedagogical purposes, such as building presence.

**Presence**

Videoconferencing implies the physical separation of teacher and learner. However, research overwhelmingly shows that of the factors associated with student learning and development that are under the “control” of teachers and schools [the educational system], the quality and effectiveness of teachers is frequently seen as the most significant (Barber & Mourshed, 2007; Hattie, 2003; Haughey, 1997; Kramas & Kopp, 2010; Rowe, 2003). In fact, a student’s ability to learn is threatened if they perceive a distance between themselves and their teacher, which Moore (1993) labels as transactional distance or cognitive space. Technology does not automatically mediate that gap. Instead, teachers need to integrate available technology with appropriate pedagogy (Clark, 2003; Maor, 2008) to create effective learning communities where students feel connected to their teacher, the content and to one another. Anderson, Rourke, Garrison and Archer (2001) proposed the Community of Inquiry framework that captures these three interactions as teaching presence, cognitive presence and social presence. This framework was designed in order to understand the complexities of text-based e-learning in post-secondary institutions and was built on a foundational perspective that emphasizes Dewey’s (1933) principle of interaction between individuals and their environment for meaning making. Implicit in this model are the following assumptions and premises:

- Deep learning is preferred
- Deep learning is acquired through inquiry and discourse
- Teachers have a significant influence in shaping the learning environment
- Teaching and learning is a both a personal and collaborative transaction.
- “Presence” is a construct that fosters inquiry and discourse and therefore, deep learning.

The key element in this model is the focus on the collaborative learning transaction between student and teacher, which is why the subtle difference in semantics (teaching presence versus teacher presence) is important. By employing this model in this my research, I take on those assumptions as well; however, for the purpose of this research, the term teacher presence will be used (outside of specific discussions of the community of inquiry model) to indicate the emphasis that this study had on the teacher. While Anderson et al.’s initial research was in the area of asynchronous, text-based, higher education courses, the concept of maximizing teaching, social and cognitive presence to close the psychological distance gap is relevant to synchronous course delivery as well (Murphy, 2010).

In the literature, teacher presence is often associated with teacher roles. Lui, Bonk, Magjuka, Lee and Su (2005) frame their study of online learning by using Berge’s (1995) four instructor roles (pedagogical, managerial, social and technical). Their findings show that the most important roles of the teacher are to be a course designer, profession-inspirer, feedback-giver, and interaction-facilitator. The latter includes student-student, student-content, and student-teacher interactions which are similar to those interactions represented in Anderson et al.’s Community of Inquiry model. Maor (2003) examined the role of teachers to develop interaction and reflective thinking in online courses and she also used Berge’s (1995) four instructor roles to frame her study of 12 graduate education students. Maor found that the pedagogical role, which included providing feedback and instruction, probing, asking questions, stimulating discussion, synthesising student’s comments and referring to outside resources, was the most important for promoting interactive learning. The impact of pedagogy on learning success is a recurring theme in the literature.
Some researchers have focused specifically on social presence in the context of internet-enabled distance learning, drawing on the assumption that learning is best constructed socially and in a community of inquiry (Bibeau, 2001; Garrison, Anderson & Archer, 2000). Social presence research is often associated with Mehrabian’s (1981) concept of communication immediacy, or the verbal and non-verbal behaviours that reduce the psychological distance between individuals. It has been shown that social presence improves student satisfaction in online learning (Gunawardena & Zittle, 1997; Shin, 2002) and perceived learning outcomes (Hackman & Walker, 1990), but there has been no research focus on social presence in an instructional context characterised by synchronous videoconferencing, specifically. Most of the research puts the responsibility of creating the conditions for presence firmly in the hands of the teachers (Anderson, 2008; Aragon, 2003), but few studies offered practical solutions for improving presence in a videoconference or identified the specific skills teachers need. This research aims to fill that gap.

2.2 Limitations of prior research

The literature review revealed three shortcomings in the body of research into videoconferencing: (1) a lack of clarity around developing presence across a screen; (2) limited attention given to course delivery in high school contexts; and, (3) little or no attention given to understanding the skill set that teachers need to overcome the barriers, leverage the affordances and develop strong learning communities in a videoconference class. There also remains a gap in the research methodology as most videoconference studies use just one case (either a single course, or a single institution). In contrast, this study studied multiple teachers who were teaching in similar ways but across eight different schools and three distinct school divisions.

2.3 Theoretical framework of current research

The theoretical paradigm that frames this study is constructivist. Constructivism stems from the work of Dewey (1933) and Vygotsky (1962) who believe that student
knowledge and meaning are socially constructed through interactions with content, culture, experience, teachers, and peers. Constructivism emphasises the relationship between knower and the known, and implies that no object can be adequately described in isolation from the conscious experiencing of it, nor can any experience be adequately described in isolation from its object (Crotty, 1998). Constructivism also infers the trustworthiness of culture and the social collective in generating and filtering meaning. This means that what people perceive or construct is, in fact, real and therefore, valuable. These commitments inform my choice of methodology, leading me to a collective case study approach (Stake, 1995) that uses mixed methods.
CHAPTER 3 – RESEARCH DESIGN

3.1 Design

This study explored the experience of teachers and students in secondary courses that are delivered by videoconference. It focused, primarily, on the construct of teacher presence, from the perspectives of both participating teachers and students. In particular, this study sought to identify pedagogy that can be employed in a videoconference setting and the skills required to do so to improve student learning.

The ability to identify the relationship between the epistemological foundation of research and the methods employed is critical for research to be truly meaningful (Darlstoun-Jones, 2007). A constructivist epistemology led me to study phenomena, such as ‘presence’, holistically and in-context. This approach allowed the in-depth study of one issue (videoconference teaching) from multiple perspectives and with multiple data sources.

The study was conducted in its natural setting, the researcher was a key instrument, and the focus was on participants’ perspectives and their meaning making. Additionally, a mixed method approach is pragmatic and uses quantitative methods, such as surveys, and qualitative methods, such as interviews and observations, to collect and interpret findings. For this study quantitative methods were used to provide descriptive data intended to support the qualitative exploration of student and teacher perceptions and experience. Creswell (2003) describes this approach as simultaneous QUAL + quant, comprising of a qualitatively-driven core component and a quantitative supplemental component. Mixing and matching data components in this way offered the best chance of answering the research questions (Johnson & Onwuegbuzie, 2004; Taskakkori & Teddlie, 2003) because weaknesses or perceived limitations in one method (e.g., qualitative) are typically supported or bolstered by the strengths inherent in another method (e.g., quantitative).
In this research, the cases comprised individual teachers who taught high school courses to remote students by videoconference. The researcher was not able to control for subject area due to the small population size from which to draw cases. In each case, the focus was on the interactions and transactions that took place within the teaching-learning context and the perceptions and experience of the participants in order to unpack the notion of teacher presence. Descriptive data about the teachers’ level of confidence, experience and perceived skill level were gathered, and rich detail about the context in which they taught was provided through observation and interviewing. Questionnaires and interviews were also conducted with students in five participants’ classes in order to understand teacher presence from their perspectives. Cross-case analysis examined the variations in pedagogy and student participants’ perceptions about teacher presence. Data analysis was mainly inductive as themes and patterns developed across the cases. An in-depth analysis of these cases was sufficient for answering the questions posed by the research.

The data were collected over three school semesters between September 2013 and December 2014 while the teachers were teaching their videoconference courses. Five discernible phases comprised the research, as outlined in Table 2.
### TABLE 2: RESEARCH PHASES

<table>
<thead>
<tr>
<th>Phase</th>
<th>Number of participants</th>
<th>Purpose/Focus</th>
<th>Qualitative or Quantitative</th>
<th>Instruments or Methods Used</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teacher questionnaires</td>
<td>8</td>
<td>To gather information about the individual cases (teacher participants) in terms of their TPACK score, level of confidence and years of experience teaching via videoconference.</td>
<td>Quantitative</td>
<td>TPACK, confidence and demographics questionnaire</td>
</tr>
<tr>
<td>Student questionnaires</td>
<td>40</td>
<td>To gather teacher presence scores for each teacher participant (case) from students’ perspective.</td>
<td>Quantitative</td>
<td>Teacher Presence Scale</td>
</tr>
<tr>
<td>Observations</td>
<td>7</td>
<td>To record the interactions and transactions that take place during a videoconference course, paying particular attention to factors identified in the literature.</td>
<td>Qualitative</td>
<td>Researcher notes</td>
</tr>
<tr>
<td>Teacher interviews</td>
<td>8</td>
<td>To gather data on teacher-participants’ strategies employed in the videoconference classroom, challenges experienced, and to clarify observations made by the researcher.</td>
<td>Qualitative</td>
<td>Semi-formal interview questions</td>
</tr>
<tr>
<td>Student interviews</td>
<td>26</td>
<td>To gather data on the student experience, their perception of teaching presence and what they expect of their VC teacher.</td>
<td>Qualitative</td>
<td>Focus group, semi-formal interview questions</td>
</tr>
</tbody>
</table>

### 3.2 Participants

The participants for this study were teachers and students from three rural school districts in Alberta, Canada. In these districts, the schools were geographically dispersed across large distances with an administration operating out of a central office. The first district had 3380 students in 33 schools, the second had 7200 students in 42 schools, and the third, which was geographically the largest, had only 1400 students in nine schools. Keeping schools open and viable so as to connect remote students to education opportunities is a constant challenge for all three districts.

Many of the schools in these districts have access to Polycom® video-conferencing technology with SMART™ interactive whiteboards and Bridgit™ software for delivering courses when human resources and funding restrict course offerings. With the support of the district technology consultant and the superintendent for each district, an expression of interest to participate in the proposed research was sent out.
to those teachers who were engaged in teaching via videoconference delivery. Thirteen teachers were invited and eight responded positively and signed consent forms. Five initially joined the study (with their students); another teacher joined shortly after the first round of data collection was completed. Eventually two more teachers volunteered to participate after they heard of the research, making a total of eight cases. The students of the initial five teachers were also invited to participate in the research by sending home an information letter and a consent form for parents and students to sign. This set of data informed the first paper by providing a multi-perspective view on presence. The researcher was unable to secure permission to include the views of students in the third school division in the study.

The teachers who participated in the study unanimously expressed a desire to improve their practice, although their enthusiasm, confidence and experience with the videoconference teaching context varied. Two of the eight teachers taught only remote students, whereas the other six had students simultaneously in front of them and on the other side of a screen during the videoconference.

3.3 Instruments

TPACK Questionnaire

The (TPACK) instrument (Appendix 1) was developed as a guiding framework by Archambault and Crippen (2006) to measure the technological, pedagogical and content knowledge and skills that K-12 distance educators should know and be able to use. Since its creation, the TPACK survey has undergone some revisions in response to a formative evaluation by expert independent reviewers. The instrument was then validated in a subsequent pilot study by the authors (Archambault and Crippen, 2009). It includes 24 items and responses are given in the form of a 5-point Likert-type scale (1 = Poor, 5 = Excellent). Each of the seven domains of TPACK (i.e., technological content, technological pedagogy, and technological pedagogical content knowledge), are represented by three to four items so that subscales can be tabulated. The items
were written based on definitions provided by Koehler and Mishra (2006). To ensure reliability, this survey was consistently administered via SurveyMonkey® and all items and wording were kept identical to the instrument used in the Achambault and Crippen study. The reason for using this instrument was to assess participant teachers’ perceptions of their knowledge and skills for the integration of technology, pedagogy and content, which then served as descriptive “baseline” data about each teacher.

**Teacher Confidence and Demographic data survey**

In addition to the TPACK questionnaire, the teachers were all presented some additional items to gather data on their experience and confidence with teaching via videoconference (Appendix 2). Teacher-participants were asked to report on the number of videoconference courses they had taught and the methods used to connect with students, along with a series of eleven general questions developed by the researcher to gauge confidence levels. The questions related to confidence in getting to know students, instructing across a screen, motivating students, managing behaviour and using technology. In addition, teachers were asked about whether they knew how to access support and resources and the extent to which they were excited about teaching with videoconference. The reason for this survey was to provide additional data about each teacher so as to develop a richer description of the context of each case.

**Teaching Presence Scale**

Participating students (who were taking videoconference courses with five of the participant teachers) were invited to complete the Teaching Presence Scale (TPS) survey, administered via SurveyMonkey® (Appendix 3). The TPS was developed and validated by Shea, Pickett, and Pelz (2003). It was designed to measure teaching presence as defined by Anderson, Rourke, Garrison and Archer (2001) in their Community of Inquiry model. The instrument was originally used to elicit student perceptions of teacher presence in post-secondary, online courses offered by the
State University of New York. In order to make the items more accessible and applicable to high school students in a videoconference course, some of the items were changed as shown in Table 2.

TABLE 3: CHANGES TO TPS ITEMS

<table>
<thead>
<tr>
<th>Changes to wording</th>
<th>Deletions and additions</th>
</tr>
</thead>
</table>
| • "Overall, the instructor for this course..." was changed to, "My teacher..."  
• "course outcomes" was changed to "goals and topic structure of the course"  
• "online environment" was changed to "online and videoconference environment"  
• "acknowledged student participation" was changed to "acknowledged my participation"  
• "helped to keep students engaged and participating in productive dialogue" was changed to "helped me to stay engaged in the course"  
• "focus discussion" was changed to “focus discussion and attention” | • Any question that asked if the "other participants" contributed to the subscales of teacher presence was removed because high school classes are much more teacher directed than post-secondary, asynchronous online courses and so these questions were not relevant to the context or study.  
• "I feel like my voice is heard in the class" was added.  
• "My teacher provided variety in the learning activities" was added. |

The final version of the adapted TPS questionnaire consisted of 17 questions that were organized under the three components of teaching presence given in the Community of Inquiry model: Course Design and Organization; Facilitation of Discourse; and, Direct Instruction. Students were asked to express their level of agreement based on a five-point Likert-type scale (1 = Strongly Disagree; 5 = Strongly Agree). In addition, eleven questions were developed around factors that have been shown to improve teaching presence that had been found in the literature, (i.e., interactivity, humour, quality of the technology, comfort with the technology, feelings of connectedness, and care). Responses to these questions were on the same five-point Likert-type scale. The reason for using the TPS was to provide some descriptive data about each teacher from the perspective of their VC students, in terms of teaching presence.

Observations

Each case has “near” (from where the teacher teaches) and “far” (where the students are learning) locations. Seven of the eight teachers agreed to have at least
one of their typical videoconference classes observed by the researcher at the near location. The focus of the observations was on teacher behaviours in regards to instruction and interaction with the students, with particular attention given to the indicators of teaching presence given by Anderson et al. (2001). It was also noted whether students appeared to be engaged, off-task, or initiating contact with their teacher. The teachers were informed of the focus of the observations and were asked to teach a typical lesson in a typical way. The observations were non-threatening and non-intrusive to ensure that the behaviours observed were not influenced by my presence. If a teaching assistant was present with the students then notes were made about the degree to which they were involved in the class. A detailed description of the physical layout of the classroom was also made. Each observation was at least 30 minutes. These field data were collected in written form.

Teacher Interviews

Each teacher agreed to participate in an in-depth interview about their experience with teaching by videoconference. The interview was designed as a conversation between the researcher and the teacher and open-ended questions were organized around a few key topics that were driven by the research questions (overall experience, instructional design, presence, interactivity, relationships, indicators of successful teaching, challenges, affordances, and training). Rapport was built with the participants in advance of the interview through informal conversation. Having taught courses by videoconference in the past, the researcher was able to relate to the context and thus put the participants at ease. The interviews lasted for 30-60 minutes and were recorded with a digital audio recorder and transcribed. The purpose of this style of interviewing was to hear what the teacher had to say in their own words and voice (Litchman, 2010).

In addition to the pre-determined interview topics, questions were asked about some of the behaviours noted in the observations and whether the teachers felt these
behaviour impacted the development of presence. Finally, teachers were given a chance to make any general comments about their experience that had not already been raised in the interview.

**Student Interviews**

In addition to the electronic TPS questionnaire, students were invited to participate in a focus group interview. Each group comprised no more than five students. The reason for the focus group rather than individual interviews was to mitigate potential feelings of intimidation on the part of the students by creating an atmosphere of conversation. It also saved time and limited the distraction to the working school day. The researcher has many years of experience with working with teenagers so was able to facilitate a balanced conversation and draw out the opinions of the quieter members. In the case of teacher A, the students were too remote and dispersed to conduct a focus group and so the student participants responded to some open-ended questions by email instead. The purpose of collecting data from the students was clearly explained to them prior to the interview; they were assured of confidentiality, and reminded of the possibility of withdrawing their participation without penalty. In addition, it was made very clear that their contribution to this research was appreciated. In this way, rapport was built with the students. These interviews were recorded by a digital audio recorder and transcribed. The questions were open-ended and led to discussion about their experience in the videoconference class. The interviews included topics such as overall learning experience, connectedness with teacher, challenges, and expectations of their teacher. Students were also given a chance to make any general comments about their experience or wishes that they had in terms of making the videoconference class better.

**Researcher as an instrument (Positionality)**

All researchers are instrument of their studies as all information is filtered through their eyes and ears and the analysis is influenced by their experiences,
knowledge, skills and backgrounds (Lichtman, 2010). In this case, the research questions emerged from my lived experience as a videoconference teacher and the belief that “it could be done better”. Denzin and Lincoln (2007) suggest that all research is guided by the researcher’s set of beliefs and feelings about the world and how it should be studied and understood. My experience of teaching in this context included challenges and joys and I leveraged that experience to design questions and discussion topics that were also anchored in the literature. However, I also listened carefully for unique challenges and teaching strategies that I had not considered or experienced myself. By repeating back answers to participants, I also honoured their “voice” by striving for accurate representation. The goal was to learn more about this experience and compile best practices and pedagogy for improved presence and learning, for both the students’ and the teachers’ sake. In this way, there is a bias toward optimism and hope. Hostetler (2005) claims that the ultimate aim of educational research is to serve people’s well-being, which in this case, is the well-being of the students and teachers. The experience, insights and feelings of the researcher are part of the qualitative research process (Stake, 1995), and this was captured through researcher reflexivity in an on-going journal.

3.4 Procedure

The data collection proceeded according to Figure 1.

Figure 1: DATA collection procedure

This mixed-method process included concurrent quantitative and qualitative phases. More priority was given to the qualitative phase, with the quantitative
instruments being used to provide baseline and supplemental descriptive data. Initial discussions about this research were had with three district administrations during the summer in advance of the data collection process. Names were put forth of teachers who were engaged in videoconference teaching. The timeframe for the data collection was three semesters. Teachers A, B and C were teaching in the first semester, teachers D E and F were teaching in the second semester, and teachers G and H were teaching in the third. Only the students of Teachers A-E were engaged in the study due to district policy. Those students were given one week to consider participation and have the consent form signed by their parents. The participating teachers provided support by helping to distribute and collect information and consent forms. It was made very clear by both the researcher and teachers that participation was voluntary.

Student and teacher questionnaires were administered via SurveyMonkey® and took about 10-15 minutes to complete. With the support of their teacher, the students who chose to participate were given time in class to complete the TPS survey. Focus-group interviews were organized in consultation with the teachers so that students could be pulled out of class on a day and at a time that was least disruptive. The teachers were extremely generous in giving up their own time for the in-depth interviews and follow-up questions and checking.

3.5 Data Analysis

Initial Preparation for Data Analysis

All identifiable names and information were stripped from the data and a key to the identification of each interviewee was locked in the researcher’s office. Within 24 hours of the interviews, the researcher developed a contact sheet in the researcher journal as suggested and described by Miles and Huberman (1994). The observation field notes were compiled and typed almost immediately after returning from the sessions. The raw interview data were transcribed verbatim by the researcher, as
relevant. Survey information from SurveyMonkey® was transferred to an Excel spreadsheet for ease of analysis and comparison. Miles and Humberman’s (1994) framework served as the guide for data analysis: data reduction, data display, conclusion drawing, and verification. The research questions were used to focus the data analysis and put aside extraneous information.

Quantitative Phase

The quantitative data consisted of TPACK scores (total and subscales) and a confidence score for each of the five teachers, and a TPS score that was generated by the students (via TPS) about each teacher. With such a small sample, these data were only used descriptively to provide a richer picture of the context. All the scores were taken from the 5-point Likert-type scale and the means calculated. These data were used to provide an objective measure of each teacher’s perceived knowledge and skills with teaching by videoconference (TPACK) and their level of confidence. These were then compared against the student’s assessment of the teacher’s teaching presence. These data were also used for some cross-case comparison.

Qualitative Phase

Inductive analysis was used to discover patterns in the data. Careful attention was given to codes that matched the literature, particularly in regards to teaching presence. The codes were then collated in a codebook with the frequency of occurrence listed and whether a code was connected to a student response or teacher response. In this way, major themes and patterns began to appear. The themes were then matched with concepts and constructs reported in the literature to see what ideas about teacher presence, teaching skills, and communication across a distance were being confirmed in the context of high school videoconference and what original ideas were emerging. Table 4 lists the main codes that were used for this phase.
TABLE 4: CODES USED FOR QUALITATIVE ANALYSIS

<table>
<thead>
<tr>
<th>Codes associated with “presence” taken from literature</th>
<th>Other codes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Naming and acknowledgement</td>
<td>Use of technology</td>
</tr>
<tr>
<td>Humour</td>
<td>Evidence of engagement</td>
</tr>
<tr>
<td>Feedback</td>
<td>Use of teaching assistant</td>
</tr>
<tr>
<td>Checking for understanding</td>
<td>One-on-one help</td>
</tr>
<tr>
<td>Design of instruction</td>
<td>Time</td>
</tr>
<tr>
<td>Affective expression (mood and emotion)</td>
<td>Tools of communication</td>
</tr>
<tr>
<td>Forming relationships</td>
<td>Logistics and classroom management</td>
</tr>
<tr>
<td>Asking questions</td>
<td>Private versus public space</td>
</tr>
<tr>
<td>Instruction across a screen</td>
<td>Training</td>
</tr>
</tbody>
</table>

**Development of Main Narrative**

The final step in data analysis was to return to the research questions and merge the results of the quantitative and qualitative phases in order to make some conclusions about the experience of teachers and students in a videoconference course.

**3.6 Limitations**

A major limitation of this study is that the data were collected from a small sample size across three rural school districts. Readers should be careful about generalizing the findings reflecting the experience of these teachers and students in a videoconferencing course and the resulting suggestions for pedagogy to potentially improve teacher presence. The researcher feels confident, however, that the quantity and quality of the interview data was sufficient for answering the research questions.

Another limitation of this study is that it did not consider the difference that subject discipline might have on the delivery of courses. Due to the limited pool of participants, the researcher was not able to control for subjects taught, and in many
cases, the individual teachers who participated in the study taught across multiple disciplines in their small schools.

As mentioned previously, the researcher was an instrument in the study. To limit the bias of the researcher, a detailed explanation of the researcher’s background, perspectives, and frame of reference has been provided to help the reader interpret the findings.

Validity of the questionnaire results may be limited by the teachers’ and students’ self-reported responses, the way they interpreted the scales and problems of self-deception. However, Spector (1994) claims that self-reported data produce valid sources of participants’ feelings and views. Furthermore, what people perceive is real and valid within the constructivist paradigm.

Additionally, teenagers are sometimes reluctant to express what they really feel, both on computerized survey items and during face-to-face interviews. Indeed, some of the students said that they were having trouble answering the questions because they were not used to being asked for their opinion on matters of instructional quality and learning experience. Careful probing and re-framing of interview questions by the researcher was required to draw out conversation and responses.

A final limitation was the use of the Community of Inquiry framework and the TPS instrument that were originally developed for text-based, asynchronous, post-secondary online courses. Not all the items were relevant for this context and so it was adapted using literature and personal judgement to modify the items. The validity of these new items was not tested, but the data were used to support and triangulate the qualitative data, not to derive causal relationships or hard conclusions.

3.7 Validity and Quality

Without an established prescription for doing mixed methods research, one needs to establish rigor and trustworthiness. Caelli, Ray and Mill (2003) believe that
four elements are required to address validity and quality: the theoretical position of the researcher, congruence between methodology and methods, strategies to establish rigor, and an explicit analytical lens through which data are examined. In this study, the research methods that were used are well-established and have been successfully used in the past. This overcame the limitation of a small sample study. Most of the research that was reviewed in the literature used case studies with a variety of quantitative, qualitative methodologies and a mixture of the two (depending on the research question) to examine presence. The qualities of the Teaching Presence Scale and TPACK questionnaire that were chosen for this research have also been well documented. This study also included a thick description of the context to help the reader interpret the results. Credibility was established through triangulation using multiple data sources (questionnaires, observations, interviews).

Many scholars of qualitative and mixed method research promote the construct of reflexivity. Lichtman (2010) views the researcher as a conduit through which all information flows. It is imperative for the researcher to continuously examine how their imbedded position might be affecting the research process and how the researcher is being shaped by the research. For this reason, a reflexive journal was kept throughout the process. Finally, this research was reviewed and checked at multiple stages by peers, supervisors and the teacher participants themselves.

3.8 Ethics

Ethics approval was granted from the Human Research Ethics Committee at Murdoch University (#2013-067) in accordance with the National Statement on Ethical Conduct in Human Resource. In addition, formal permission to conduct the research as planned was given from the superintendents of the three school districts. The students were minors and so consent was granted from the participating school districts, schools, and parents. Participants, the schools and the district were assured of confidentiality and reminded that they could withdraw from the study at any time. All
data gathered were de-identified. The researcher ensured minimal disruption to the normal teaching and learning day. Information about the background of the research and the method of reporting was provided to all stakeholders.
CHAPTER 4 – PUBLICATIONS

Paper 1 - Investigating teacher presence in courses delivered by synchronous videoconference


Research Aim

The aim was to examine the construct of presence in a course delivered by videoconference. It was grounded in the assumption that there is a relationship between reported high teacher presence, student satisfaction, and learning outcomes. However, it was unclear which factors might lead to high presence in a videoconference course and which of those factors were under the control of the teacher. The study used mixed methods to gather data from five teachers and their students about pedagogical, content, and technological knowledge (TPACK). Further investigation explored teachers’ experiences, teacher confidence, student expectations, and teacher behaviours to get a rich understanding of presence in this context.

Research Questions

1. How do the teachers’ perception of their own technological pedagogical content knowledge and confidence as well as their experience impact presence?
2. What do high school students expect of their VC teachers in terms of presence?
3. What actions do videoconference teachers take to increase presence in their courses?
4. What is the impact on presence when videoconference teachers are required to teach remote and face-to-face students simultaneously?
Investigating teacher presence in courses using synchronous videoconferencing

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\textbf{ABSTRACT}

This research examines teacher presence in high school distance courses that are delivered by synchronous videoconference. In rural and remote areas, many school districts are using videoconferencing as a way to reach dispersed students. This qualitative case study uses mixed methods to unpack the notion of presence from the perspective of teachers and their students. This study reports four key findings which have implications for building presence in a videoconference course: teachers' confidence and experience aligned with higher presence; teaching videoconference and face-to-face classes simultaneously led to challenges with developing presence; immediacy behaviors correlated with higher presence; and, students' learning preference related to perceived teacher presence. These findings confirm many of the issues raised in the literature about technology integration but also contribute new perspectives on teaching presence in a videoconference.

\textbf{Introduction}

Videoconferencing technology offers an enticing opportunity for distance education providers to connect geographically distributed students and teachers through real-time, two-way video. As the cost of hardware decreases and high-speed Internet becomes more accessible, many schools and districts are choosing videoconferencing to meet the educational needs of rural and remote students and those who cannot attend school for other reasons (Bower, Kenney, Dalgarno, Lee, & Kennedy, 2014; Greenberg, 2009). Although videoconferencing is a cost-effective way to connect distance students with qualified teachers (Anderson, 2008; Lawson, Comber, Gage, & Cullum-Hanshaw, 2010; Twigg, 2001), there are very few resources to support teachers who find themselves teaching students across a screen (Bower et al., 2014). Teachers need concrete strategies and clear guidance on how to teach effectively and connect with their students in a course delivered synchronously by videoconference.

Research into asynchronous, fully online modes of course delivery, particularly for the higher education sector, is growing (Maor, 2008). Few studies, however, look at the unique
context of synchronous delivery of courses to non-adult learners by videoconferencing (Alberta Education, 2006; Murphy, Rodriguez-Manzaneares, & Barbour, 2011). When a course is delivered by videoconference, students see their teacher almost daily for a scheduled block of time, during which, the teacher uses direct instruction in a live format to explain content and tasks, and engage learners through interactive activities. As in online learning, there is a geographical distance between the teacher and student, which leads to both a real and a perceived barrier to communication and connection (Moore, 1993). The result of this barrier is a decreased sense of being there, which is otherwise known as presence (Anderson, 2008), a construct that has been investigated and conceptualized through the community of inquiry framework (Garrison, Anderson, & Archer, 2000). Building relationships and rapport between the teacher and the students is critical to a positive learning environment (Munroe, 1998), and the real and perceived distance in a videoconferencing classroom makes it more difficult to create this atmosphere.

A unique set of skills and strategies are therefore required by the teacher to bridge this distance, connect with students, and develop presence (Barbour, 2013). The teacher has an important influence on the cognitive, affective, and behavioural outcomes of schooling for students (Hattie, 2003; Haughey, 1997; Kramas & Kopp, 2010; Rowe, 2003). Based on the assumption that the teacher is critical to student success, and the fact that videoconferencing exists in situations where students are physically separated from their teacher, the goal of this research has been to examine the notion of presence to determine how teachers can better develop in this unique context. The research questions that drove this study are:

1. How do the teachers' perception of their own technological pedagogical content knowledge (TPACK) and confidence as well as their experience impact presence?
2. What do high school students expect of their videoconference teachers in terms of presence?
3. What actions do videoconference teachers take to increase presence in their courses?
4. What is the impact on presence when videoconference teachers are required to teach remote and face-to-face students simultaneously?

Presence

Presence is generally considered to be a sense of awareness, receptivity, and connectedness to the mental, emotional, and physical workings of the individual and the group in the context of their learning environments (Rogers & Raider-Roth, 2006). Presence has also been defined as 'the perceptual illusion of non-mediation' (Lombard & Ditton, 1997, p. 16), which means that presence gives participants who are geographically dispersed the feeling of being there and being together. Gunawardena and Zittle (1997) refer to this as the degree to which a person on the other side of a screen (or computer) is perceived as being 'real' (p. 9).

As a construct, presence is well documented in the literature, although mostly in studies of asynchronous, fully online adult education. Arising from their research into communities of inquiry in distributed learning contexts, Garrison et al. (2000) proposed a framework for understanding presence, which identifies three elements: teaching presence, social presence, and cognitive presence. Cognitive presence refers to the construction of meaning or the acquisition of knowledge by participants; in other words, it is the primary goal of education.
It is based on Dewey's (1933) notion of reflective thinking or meaning-making through discourse, and challenges the practice commonly seen in videoconferencing of content delivery through direct instruction. Garrison et al. argued that a strong social presence needs to exist for cognitive presence to flourish. This is because social presence, or the perception of feeling connected to others, leads to higher levels of comfort and satisfaction for teachers and students. Teaching presence is defined as 'the design, facilitation and direction of cognitive and social processes for the purpose of realizing personally meaningful and educationally worthwhile learning outcomes' (Anderson, Rourke, Garrison, & Archer, 2001, p. 5). Therefore, teaching presence serves to initiate and maintain an environment where social presence, and therefore cognitive presence, can flourish. Teachers are responsible for creating the conditions in which students feel connected, supported, and safe to construct meaning, and this requires deliberate effort (Aragon, 2003). In the context of videoconferencing, teachers need to develop presence across a screen and across a distance. Since students' sense of distance can threaten their ability to learn (Moore, 1993), reducing this psychological distance is critical for teachers in a videoconference course.

Previous studies in other distance education contexts can shed some light on the ways that teachers develop presence during videoconferencing. Some scholars operationalize presence in terms of immediacy behaviors, defined as the degree of perceived physical and/or psychological closeness between people (Mehrabian, 1981). Teacher immediacy includes both verbal behaviors (e.g., use of names, tone of voice, use of inclusive pronouns) and non-verbal behaviors (e.g., posture, facial and hand gestures, use of classroom space). Originally used to understand communication in face-to-face relationships, immediacy behaviors have also been applied to distance education contexts. Immediacy has been linked to improved presence (Baker, 2010), and studies have shown how both constructs improve student satisfaction and perceived success (Hackman & Walker, 1990; Witt, Wheelless, & Allen, 2007).

In a technology-mediated learning environment such as a videoconference, teachers need to have proficiency with technology. In addition to pedagogical skills and knowledge of curriculum, Koehler and Mishra (2009) argue, however, that technological knowledge on its own is not sufficient to ensure effective instruction. They proposed the TPACK framework that broadened Shulman's (1987) original pedagogy-content model to show how these three domains of knowledge need to come together for effective integration of technology. In other words, they believe that a teacher's knowledge of subject matter and pedagogy does not assume the transfer of knowledge for incorporating appropriate technologies for teaching effectively. The TPACK model has received some criticism for its theoretical immaturity (Graham, 2011) and its lack of clarity around the subcategories (Cox & Graham, 2009), and so we acknowledge, with Niess (2011), that TPACK is dynamic and gradually evolving. This has led to the development of a number of instruments for measuring TPACK, including self-report questionnaires and performance-based assessments (Jamsieson-Proctor et al., 2013; Koehler, Shin, & Mishra, 2012). The instrument chosen for this study was Archambault and Crippen's (2009) survey due to its similarity of context and ease of administration. Videoconferencing technology was not originally designed for education purposes, rather as a business communication tool (Lawson et al., 2010), and for teachers to integrate this technology effectively in distance education courses, they need to merge their knowledge of the technological tools with their existing pedagogical beliefs (Ermer, 2005), including those that lead to increased presence.
For the purposes of this study, the researchers conceptualized presence as a construct that encapsulates the community of inquiry framework proposed by Garrison et al. (2000), feelings of 'realness' described by Gunawardena and Zittle (1997), and the perception of 'closeness' reported by Mehrabian (1981) and Moore (1993). In other words, when teachers design distance learning environments in which the students feel close to their teacher and peers as real people, then presence would be high. As indicated above, research shows that increased presence correlates positively with perceived student success and satisfaction. It is unclear, however, how teachers might develop it in a high school course delivered by videoconference. This research addresses that gap.

Method
Research design
This study explored the experiences of teachers and students in secondary school courses that are delivered by videoconference, focusing on the construct of teaching presence. A constructivist epistemology, holistically and in-context, informed the research. The following collective case study approach used mixed methods to allow for an in-depth study of teacher presence from the teachers' and students' perspectives using multiple data sources (questionnaires, interviews, and observations). The focus was on the interactions and transactions that took place within the videoconferencing class context and the perceptions and experiences of the teacher and student participants. Quantitative methods provided descriptive data to support the qualitative exploration of student and teacher perceptions and experience. Morse and Niehaus (2009) describe this approach as simultaneous QUAL + quant, comprising a qualitative core component and a supplementary quantitative component. Mixing methods in this way offered a stronger chance of answering the research questions than would a mono-method design (Johnson & Onwuegbuzie, 2004; Tashakkori & Teddlie, 2003).

During the study, teachers were surveyed about their confidence and experience with videoconferencing, and perceived skill level with technology. Using observation and interviews, rich detail about the context in which they teach was gathered. We also conducted questionnaires and interviews with students in the observed classes to understand teacher presence from their perspectives. We then used cross-case analysis to look for variations in pedagogy and perceived teacher presence from students' perspectives. Data analysis was primarily inductive as themes and patterns developed across the cases.

Participants
The participants for this study were teachers and students from two rural school districts in Canada. In both districts, schools are geographically dispersed across vast distances with an administration operating out of a central office. Many of the schools in these districts have access to Polycom® videoconferencing technology with SMART® interactive whiteboards and Bridgit™ software to deliver courses to one another. The students in this study were required to take a videoconference course because they were attending a remote, rural school that had limited face-to-face course offerings and human resources.

With the support of the school district technology consultant and superintendent for each school district, we invited teachers using videoconferencing to the study, and five teachers agreed to participate (labelled teacher A–E). All five teachers had been teaching
for over 10 years but had varying degrees of experience with videoconferencing and were assigned labels accordingly: novice (fewer than two courses); moderate experience (between two and five courses); experienced (more than five courses). Three of the teachers taught a face-to-face class simultaneously with the videoconference course, whereas the other two teachers only had videoconference students. The students of these teachers were also invited to participate in the research. In total, all 40 students completed the teaching presence scale survey, and 26 students took part in focus group interviews.

**Instruments**

The Archambault and Crippen (2009) TPACK instrument was used to measure teachers’ perceptions of their TPACK to see if it impacted teacher presence. This was chosen because it had K–12 data that could be used comparatively. It includes 24 items, and responses are given in the form of a 5-point Likert-type scale (1 = poor; 5 = excellent). Construct validity was established through expert consultation, item revision and two phases of a pilot study. Results from Archambault and Crippen’s study (n = 596) showed an average self-reported TPACK score of 3.75 among K–12 distance educators; this has been used as an average benchmark in this study for comparison against a larger sample. In addition to completing the TPACK questionnaire, the teachers engaged with some additional questions to gather data on their experience with videoconference teaching. They also responded to a series of general questions (developed by the researchers) to gauge their level of confidence with the videoconferencing context. The reason for this survey was to provide further data about each teacher to see if experience and confidence impacted the ability to develop presence.

Each teacher agreed to have at least one of their typical videoconference classes observed by the researcher. The focus of the observations was on teacher behaviors in regards to instruction and interaction with the students, with particular attention given to the indicators of teaching presence as outlined by Anderson et al. (2001). Teachers were informed of the purpose of the observations and were asked to teach over the videoconference and interact with students in a typical way. The teachers also participated in a 1-h interview with open-ended questions about their experience teaching by videoconference. The interview questions focused on the development of presence—what strategies they used to maximize those feelings of connectedness, and how successful they felt they were at it.

Participating students were invited to complete the teaching presence scale survey (Shea, Pickett, & Pez, 2003) to provide some descriptive data about each teacher’s presence from the perspective of their videoconferencing students and to compare these results with the teachers’ self-evaluation (via TPACK). The stance on teacher presence implicit in this scale follows the community of inquiry framework (Garrison et al., 2000). A 5-point Likert-type scale was used to measure each item on the scale with a score of five indicating high teaching presence and a score of one indicating low teaching presence. In addition to the electronic TPS questionnaire, some students participated in a focus group interview. The purpose of these focus groups was to have the students share their experience of videoconferencing, in their own words, and in a non-threatening way. The students were asked questions that focused on the expectations they had of their videoconference teacher and the indicators of presence that are reported in the literature. In total, there were seven focus groups, each with no more than five students. In one of the cases (teacher E), the students were too remote and dispersed to participate in a focus group but two of them responded to some open-ended questions by email.
Analysis

Miles and Huberman's (1994) framework served as the guide for data analysis. The quantitative data obtained from the three surveys (TPACK, confidence, and TPS) provided rich, descriptive detail of the videoconferencing context. These data were used to give an objective measure of the teachers' perceived knowledge and skills with teaching by videoconference (TPACK) and their level of confidence and then to compare these to the students' assessment of their teaching presence. To discover patterns in the qualitative data, the researchers employed inductive analysis. Interview transcripts and observation field notes were given initial codes, which were then sorted into themes. The themes were then matched with concepts and constructs reported in the literature to see what ideas about teacher presence, teaching skills, and communication across a distance were being confirmed in the context of high school videoconference and what original ideas were emerging. The final step in the data analysis process involved the researchers returning to the research questions and using the results of the quantitative and qualitative phases to draw tentative conclusions about presence in courses delivered by videoconference. Credibility was established through the triangulation of the quantitative data, the qualitative data and the literature.

Findings and discussion

Four major themes emerged from the analysis:

- teachers' levels of confidence and experience aligned with higher student reported presence, more so than self-reported TPACK,
- teaching by videoconference during a face-to-face class led to challenges with developing presence,
- teacher immediacy behaviors and feelings of interpersonal connectedness correlated with higher presence, and
- students' learning preference related to teacher presence.

The following section unpacks and provides support for each of these findings.

TPACK, confidence, experience, and presence

The results from the quantitative phase of the study were used to determine if there was a connection between the teachers' self-reported TPACK, their confidence, experience, and the students' assessment of their presence. Figure 1 presents these quantitative results. Teachers A, B and C taught face-to-face and remote students simultaneously while teachers D and E taught only remote students.

There are a few observations to be noted about these data. Firstly, the teachers with the most experience (teachers D and E) did not self-report correspondingly high TPACK scores compared with the less experienced teachers. We suggest that teachers with more videoconference experience likely have a more accurate idea of what they do not know and therefore rated themselves more conservatively on questions about their TPACK. Teachers A and B rated themselves comparatively high (4.5 and 4.6 out of 5, respectively) despite having little experience in this unique context. In the interviews that followed, it was determined that these two teachers were quite tech-savvy and despite having less experience
with videoconference hardware and software specifically, they felt that they would learn quickly.

Secondly, based on what the research says about TPACK (Koehler & Mishra, 2009), we expected that the teachers who self-rated higher technological pedagogical knowledge would also be better at building presence in the technology-mediated context of a videoconference than those who reported lower knowledge, but the data did not reflect this. Although teachers A and B in our study produced the highest TPACK scores, this did not translate to the highest presence scores according to their students (3.5 and 3.5). In contrast, teachers D and E had the highest presence reported by their students (4.0 and 3.9, respectively) but their TPACK scores were lower than those of teachers A and B and much closer to the average score of 3.75 reported by Archambault and Crippen (2009).

The only teacher with TPACK and presence scores that seemed to align was teacher C. This teacher had the lowest TPACK score (3.5), caused mostly by a very low technological knowledge sub-score of 2.0, and also the lowest presence score (3.3). It seems that the TPACK instrument failed to pick up something important here as the teachers' sense of being tech-savvy or belief that they had the knowledge to teach with technology was not necessarily reflected in building presence across a screen, from the perspective of their videoconference students.

Although a minimum level of comfort with technology is required, we suggest technological proficiency is not enough to ensure effective instruction in a technology-mediated environment, such as a videoconference. Instead, the data show that higher levels of confidence and experience aligned more closely with higher levels of presence. In particular, teachers D and E had the most experience, the highest self-reported confidence, and the highest presence scores. This experience gave those teachers a better understanding of the context and the challenges, and how pedagogy needed to be adapted to ensure learning. They had spent more time testing out different strategies for connecting with their students,
received high presence scores from their students. Being able to give all their attention to the students on the other side of a screen helped bridge the psychological distance.

The three teachers who were teaching remote students through the videoconference simultaneously with their regular face-to-face class had a harder time creating presence in comparison to the teachers who only had remote students in their classes. This suggests that videoconference teachers need to be creative and innovative to involve the students in the process of learning via videoconferencing. It requires teaching strategies that involve the face-to-face students interacting frequently with the far students to increase immediacy, or secured time for questions and answer, pal writing, and so on. There were too many immediate distractions in the face-to-face class, and subsequently, the remote students felt like audience members rather than equal classmates. This aligns with the findings reported by Knipe and Lee (2002) in their comparison of the experiences of local and remote students in a videoconference.

**Immediacy and interpersonal connectedness**

Mehrabian (1981) conceptualized immediacy as the degree of perceived physical and/or psychological closeness between people. He provides examples of immediacy behaviors: use of names, use of inclusive pronouns, posture, gestures, and use of classroom space. Through teacher interviews and observation, we identified a number of these teacher behaviors (see Table 1). We then noted any correlation to what their students said about presence.

Teachers D and E, who received the highest presence scores from their students, stood and spoke directly into the camera, used humour, and employed strategies for calling students by their individual names. For example, teacher E kept a list of names by her desk and checked them off as she called on each one so as to ensure each name was spoken at least once each class. Some of these immediacy behaviors were confirmed during the student interviews such as, 'I like how she jokes around with us and makes it so that everyone has a say' (student of teacher E), and 'She uses our names to get our attention' (student of teacher D). In contrast, teacher A, who received the lowest presence score, rarely used student names: 'I think he knows our names but he doesn't use them' (student of teacher A). Using individual

<table>
<thead>
<tr>
<th></th>
<th>Teacher A</th>
<th>Teacher B</th>
<th>Teacher C</th>
<th>Teacher D</th>
<th>Teacher E</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gestures</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Vocal variety</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Looks at class</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
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</tr>
<tr>
<td>Smiles</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Relaxed body posture</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Removes barriers between self and students</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Calls students by name</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Uses inclusive pronouns</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Informal talk</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Gives feedback</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Self-disclosure</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Uses humour</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>
student names was a common theme in the data. Almost all the students desire and expect to be known and acknowledged by this simple gesture. While this is considered generally good practice in teaching, it is even more important in a videoconference. These findings support previous research (Baker, 2010; Bozkaya & Erdem Aydin, 2007) that shows that immediacy behaviors such as these mentioned above improve perceptions of presence.

Instructor self-disclosure is also listed as an immediacy behaviour (Mehrabian, 1981), and teacher C made a deliberate effort to do this. She purposefully shared personal stories with her students about her family and interests, and the students appreciated this, commenting: 'We got to know her a lot better because she added a bit of a personal aspect to the classes and this made us feel connected' (student of teacher C). While this action was noted by the students during the focus group interviews, it was not enough to translate into a high presence score on the TPS questionnaire. Other factors, such as her low technological proficiency and the simultaneous teaching format, overshadowed this simple immediacy behaviour when students assessed this teacher's presence.

Social presence can be improved in online courses with an initial face-to-face meeting of the group (Garrison, 2011). We asked participants in this study about meeting face-to-face at some point during the semester, and they all spoke positively of the idea. Teachers D and E visited their remote sites at least once a semester so that their students could see a real person. In addition to this, teacher E kept track of when her students came into the city so she could go and meet them or watch them play sport. The students of teacher D said, 'It was strange to have her teach us before we had ever met her', and they agreed that following the school visit, they felt more comfortable. Teachers A, B and C all indicated that they would like to visit their students but time and logistics did not allow it. In previous years, teacher B went to the remote site and taught his far students face-to-face while giving his near students the experience of videoconference. He said that after that experience, he felt he was more connected to his students and knew their names better. Teacher B had not had the chance to meet his students this year but he employed an asynchronous tool to elevate connectedness and social presence in the classes. He used Google + Communities to disseminate information and connect students to one another. A survey of the activity logs shows that students were posting photos and introducing themselves in the first few weeks of class. Teacher B did not think the students were making much use of this tool, but a few of the far students noted that the 'get-to-know-you task made them feel more connected to their peers and teacher'. One student stated that, 'even though he doesn't ask us anything personal, he knows about us because of what we wrote on Google + Community.' Anderson (2008) found that blending synchronous and asynchronous technologies in this way improved presence. While the students of teacher B noted feeling more connected, it was not reflected by a high presence score. We suggest that the strategies of teacher B to connect with his students through asynchronous social media tools did not replace the positive benefits of meeting face-to-face.

When asked to report on the barriers to presence, many participants referred to the public nature of the videoconference. The far students who were sharing the instruction with their face-to-face peers reported feeling intimidated: They were happy to watch, listen, and work independently, but asking questions and speaking aloud was difficult for them because their voices and images would be projected into the whole classroom. Many students commented on this effect, for example:

'I don’t know what my voice sounds like and I don’t want to sound stupid.' (Student of teacher A)
It feels kind of awkward to ask a question because it will be projected to the whole class. (Student of teacher C)

The teachers also felt frustrated by the lack of space for informal, personal connections with their students. They were aware that some subjects are more sensitive and not appropriate for the video screen. Teacher E explained, "I can watch for subtle body language and listen for negative voice tone to know if a student is frustrated or stressed, but it is difficult to then communicate privately with them to see if they are OK." When asked about building relationships and establishing presence, teacher D said it was hard, also citing the limitations of the public nature of the conference:

You can't whisper a private conversation with somebody. One of my students had an operation last week and I can't ask them about it on the screen because it is not a public kind of thing.

Lobel, Neubauer, and Sweedburg (2002) have proposed the concept of a privacy zone in learning as the subjective experience of personal safety, the extent and reliability of which will improve an individual learning experience. The data show that this privacy zone could apply to the videoconference context as well.

Learning preference and interactivity

Lecturing (or teacher-led instruction) was the most common teaching approach observed in this study. The teachers conceded that this was not the ideal approach but chose to instruct in this manner because it was the easiest. According to Murphy et al. (2011), synchronous teaching does lend itself to more teacher-centred than student-centred styles, which Lowenthal (2009) suggests is a barrier to presence. Interestingly, the students who took the majority of their other courses by traditional, correspondence modes and were used to learning independently said that they liked having a real teacher to explain the difficult concepts to them. While the literature shows that learning that is designed to be interactive leads to higher presence (Baker, 2010), these students liked the high proportion of lecturing. The students who took the majority of their other courses in a face-to-face classroom, however, indicated that they were expecting more from their videoconference teacher in terms of interactivity: 'I feel like if she was in the room then she wouldn't talk as much and we would do more activities' (student of teacher D). They blamed the videoconference format, not their teacher, for the large amounts of lecturing, a response that has been reported elsewhere (Doggett, 2008; Gillies, 2008). Attributing the lecturing format to the videoconference and not the teacher is likely why teacher D still received a high presence score. It appears that student preference for interactive or lecture-based instruction depended on the course format of their previous distance education experiences. Paired with other presence-building actions, some students found that the teacher-centred nature of the videoconference was effective compared to learning the material on their own.

Questioning is a form of interaction that indicates social presence (Garrison, 2011). However, from the teachers' perspectives, students rarely initiated questions. The students of teacher B said that they knew they could ask questions and they often observed the near students approaching their teacher's desk to seek individual help, but they did not ask for help themselves because, 'He is often busy talking to the students there and we don't want to interrupt!' One of the students proposed a solution: 'Have a designated day or time for us to ask questions. Then we would know it was our time to get help' (student of teacher B). This suggests, again, that they felt like intruders in the face-to-face class each time they
spoke up on the videoconference. Teacher A mentioned a few tactics that he had tried to provide space for the far students to ask questions. For example, he initiated a live online chat during class, but reported that the students were not making use of it. After setting up the tool, he left the students to choose whether or not to engage with it rather than directly prompting them to ask questions on specific topics and at specific times. These same students of teacher A made clear a desire to break down the communication barrier and suggested that it was their teacher's responsibility to do so by purposefully engaging them in opportunities to speak. In contrast, teacher E, who had a high presence score, persisted in engaging her students to seek help. She offered additional tutoring time outside of regular class and invited her students to contact her outside of school hours (by text or email) if they needed help. The students appreciated this approach. One of her students commented, 'My teacher is amazing. She takes the time to go through stuff with us and if we need extra help then she is more than willing to stay and do that.'

Students expected their teachers to check regularly for understanding and provide informal feedback. In face-to-face classes or traditional correspondence courses they perceived avenues in place for them to keep updated on progress, but felt this was lacking in the videoconference course. When asked to comment about instructional strategies that would make them feel connected, a student of teacher B mentioned, 'I'd like it if he came every morning and said, "Is there anything I can help you with? Did you understand the homework?" Checking up to see if we understand would improve the situation.' This regular feedback would, in the students' opinions, provide a level of interactivity that leads to higher ratings of teacher presence.

Concluding remarks

This study examined the experiences of teachers and students in distance education courses using videoconferencing in order to understand how presence is viewed in this unique context. The research questions focused on how teachers' perceptions related to their TPACK impacted presence, what expectations students have of their videoconference teachers in terms of presence, what the videoconference teachers were doing to successfully increase presence in their courses, and the challenges associated with teaching face-to-face and remote students simultaneously.

Presence in this study was based on the results of a teaching presence survey that the students and students completed, observations made in the classroom, and interviews with both teachers and students. The findings, as discussed above, confirm many of the issues raised in the literature about technological integration but also contribute new perspectives on TPACK, presence and distance education delivered by videoconference. Participating teachers' self-perceptions of their TPACK did not necessarily result in higher presence in the videoconference setting. Instead, the findings show that experience and confidence better aligned with higher presence.

While it was shown that a minimum technological proficiency is required to create presence in a videoconference setting, this was not sufficient. Teachers need to learn how to adapt pedagogy to the technology, but without resources and training readily available it takes considerable time to try and refine new strategies. This may have been the main reason why those teachers with more videoconference experience did better. However, even those teachers with comparably effective videoconference classes had room to improve
alongside their lesser effective colleagues. All the teachers in the study talked about the challenges of using their prevailing teaching methods with the new technology. We suggest that a complete paradigm shift is required whereby teachers think about the affordances of a videoconference and then design their courses to exploit these innovative aspects. While connecting distance education students to real teachers who can explain concepts through lecture is one of those affordances, the technology also lends itself to more interaction in the form of teacher feedback and peer collaboration. The technology itself will not make distance education courses good, nor close the psychological distance felt by participants; instead, we agree with Murphy and Coffin's (2003) assertion that teachers have a responsibility to adapt their pedagogy to suit the technological context so that presence is developed to support far students' learning.

Disclosure statement
No potential conflict of interest was reported by the authors.

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References


Paper 2 - Navigating the challenges of delivering secondary school courses by videoconference


Research Aim

The aim was to understand the challenges that videoconference teachers face and give voice to their concerns. Videoconference teachers are largely isolated due to the fact that they teach in rural areas and this study looked for consistencies in their experiences despite the fact they mostly operate isolated from one another. The researcher inquired into the barriers teachers faced and also some concrete ways that those barriers have been overcome, either through trial and error, or sharing of ideas. This study combined some of the qualitative data from participants in the first study with an additional set of data from a sixth participant. The findings of this study resulted in a set of recommendations for teachers and administrators to improve the videoconference teaching experience.

Research Questions

1. What challenges do teachers face when teaching by videoconference?
2. How have teachers who use videoconferencing overcome the challenges associated with this unique modality?
Navigating the challenges of delivering secondary school courses by videoconference

Nicole Rehn, Dorit Maor and Andrew McConney

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Abstract
The purpose of this research is to unpack and learn from the experiences of teachers who deliver courses to remote secondary school students by videoconference. School districts are using videoconferencing to connect students and teachers who are separated geographically through regular live, real-time conferences. Previous studies have shown the inadequacy of videoconferencing to create effective learning communities when used solely as a lecturing tool, but there is limited research into understanding how to mitigate the challenges in order to leverage the tool for what it affords. This collective case study uses qualitative methods to examine those challenges and propose strategies for overcoming them. Five obstacles were identified (insufficient time, feelings of isolation, scheduling and logistics, unreliable technology and limited personal connection) with the following recommendations: leverage supporting tools, intentionally build presence and prioritize the programming within the district.

Introduction
Education has been “disrupted” by rapid advances in communication technologies (Staker, 2011). This is particularly evident in the area of distance education as it has evolved from print-based correspondence courses to real-time, interactive classrooms connected through the Internet (Bower, Kenny, Dalgarno, Lee, & Kennedy, 2014; Cavanaugh, Barbour, & Clark, 2009). Videoconferencing, specifically, connects users in real-time across distance with synchronous audio and video, and many school districts are taking advantage of it to provide dispersed students with access to specialized teachers where human resources and course offerings are otherwise limited. This is particularly the case in Canada, where many school divisions face the challenge of providing education to remote and rural students. Barbour and LaBonte (2014) reported that 6% of Canadian students took courses by distance education in 2013–14, which reflects a steady increase over the last few years. Within the province of Alberta, where this research was conducted, the numbers are much higher (12%), due in part to the predominantly rural geography and government investment in internet infrastructure. Specifically, the Alberta government has spent $13.5 million to support videoconferencing capacity in K-12 classrooms, and there are currently 800 videoconference units distributed in schools across the province (Videoconferencing, n.d.). Videoconferencing is also being used as a mode of course delivery in other K-12 jurisdictions around the world. In the United States, rural music students in Nebraska are connected to specialized teachers in New York (McFarland, 2013); and in other parts of Canada, videoconferencing helps the provision of courses to high school students in isolated areas of Newfoundland.

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Practitioner Notes
What is already known about this topic

- Improved technology has allowed school districts to adopt videoconferencing as a solution for connecting remote students to specialized teachers and courses.
- When videoconferencing is used solely to deliver lectures, it is not effective for creating successful learning communities.
- Interactivity is not inherent in the technology. Instead teachers need to leverage the technology to create interactive learning communities.

What this paper adds

- Insight into the specific experiences of K-12 teachers who deliver distance education courses by videoconference.
- Identification of the challenges for teachers inherent in videoconference course delivery.
- Strategies for successfully overcoming the challenges that teachers face in this context.

Implications for practice and/or policy

- Videoconference teachers should employ additional technological tools and leverage the onsite facilitator to improve interactivity, develop interpersonal connections and mitigate organizational challenges.
- Videoconference teachers must be supported to make a pedagogical paradigm shift from traditional teaching methods to student-centered learning in order to focus on creating interactive, connected classrooms.
- School administrators should prioritize support for videoconference programs in order for teachers to mitigate the challenges inherent in the teaching modality.

and Labrador (Barbour, 2007; CBC News, 2013). New Zealand has employed video conferencing technology to offer more subject choices for rural high school students since the 1990s (Roberts, 2009). In addition, Australian distance education providers, who have previously used radios to connect remote learners in real-time through their “School of the Air” programs, are now switching to video-based platforms as internet connectivity improves in these areas (Vize, 2014).

While videoconferencing is a cost-effective modality for distance education, there is limited research into its best practices (Lawson, Comber, Gage, & Cullum-Hanshaw, 2010). Teachers, therefore, must “feel their way” through the experience with trial and error rather than use research-informed practices (Anderson, 2008a). Teachers end up adopting traditional teaching methods within the new context, even though research has shown that transferring face-to-face classroom approaches directly to the videoconference context is inadequate (Alberta Education, 2006; Gillies, 2008). This research aims to better understand the challenges inherent in videoconference course delivery in order to contribute new strategies and recommendations for teachers and administrators that are likely to improve practice.

Focusing on the experiences of six teachers who instruct courses by videoconference in Alberta, the study provides recommendations that can inform future practice by investigating the following inquiries:

1. What challenges do teachers face when teaching by videoconference?
2. How have teachers who use videoconferencing overcome the challenges associated with this unique modality?

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Literature review
Research that supports K-12 internet-enabled distance education is slowly growing but much of the focus is on asynchronous online learning (Barbour, 2013; DiPietro, 2010). Studies of videoconferencing, specifically, are limited, and those that exist generally focus on the ways in which the technology can be used to supplement curriculum (Lim & Freed, 2009; Park & Bonk, 2007) rather than for standalone course delivery. A study on K-12 videoconferencing in Western Canada (Anderson, 2008a) found that the technology is not sufficient for creating successful learning communities if used as a tool of instruction to solely deliver lectures. Indeed, Smyth (2005) had previously argued that video-conferenced courses would improve if the technology was blended with various other tools to create a learner-centered, interactive learning experience. Interactivity, in particular, is a recurring theme in distance education literature, especially in terms of its positive effect on student learning (Anderson, 2008b; Cavanaugh et al., 2009; Fulford & Zhang, 2009; Maor, 2003). However, while technologies, such as videoconferencing, afford interactivity in distance education courses (Andrews & Kelsee, 2002), it is the pedagogy that determines the degree of interactivity present (Kaceski & Kaceski, 2013; Maor, 2008; Murphy, Rodriguez-Munizanares, & Barbour, 2011). Murphy and Coffin (2003) reported that the limitations of the tool sometimes prevent effective interactivity and communication but suggest that these challenges could be mitigated. Roblyer, Feeman, Stabler, and Schmidmuller (2007) conducted an evaluation of the Alabama Access Initiative, which used videoconference technology as part of its synchronous distance education programming to provide courses to remote students and reported the following challenges: development of relationships, sound quality, reliability of technology, additional administrative duties and lack of flexibility of time. Gilles (2008) asserted that the repeated drawbacks of using videoconferencing technology, such as those noted by Roblyer et al. (year) can be mitigated by teacher professional development and the adjustment of teaching approaches. While the Gilles study makes a contribution to our understanding of videoconferencing pedagogy, like many others (Doggot, 2008; Karal, Cebi, & Turgut, 2011), it focuses on a post-secondary settings instead of a K-12 one.

While prior research shows that teachers require support and know-how to navigate the challenges of videoconferencing, there continues to be a lack of empirical research that focuses on what this specifically and practically looks like. This study aims to address that gap by focusing on the experiences of six teachers in videoconference classrooms. By improving our understanding of the challenges involved with videoconferencing education, we can better develop strategies and/or recommendations that will support teachers in this new and evolving pedagogical role and improve the learning experience for their students.

Methods
Design
A collective case study approach (Stake, 1995) focused on the experiences of teachers and the challenges they faced when teaching by videoconference. The administration of three participating school divisions granted the researchers permission to work with teachers, and provided the names of seven teachers who were teaching by videoconference. A letter of invitation and consent form was sent to those seven teachers and six responded positively and enthusiastically, unanimously citing a desire to improve their teaching practice and explore strategies to overcome the challenges they face. They were all assured confidentiality, and given the option to withdrawal at any time. The nature of the study posed no risks to the participants. The teachers were all expert teachers with varying amounts of videoconferencing experience from 1 to 4 years. Four of the teachers taught their videoconference course while simultaneously teaching students face-to-face and the other two teachers had only videoconference students in their course.

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Qualitative methods including class observations and semi-formal interviews were used to collect data from six teachers who delivered courses to rural students by videoconferencing. Each case had a "near" (from where the teacher teaches) and a "far" (where the students are learning) location and five of the participants agreed to have at least one of their typical videoconference classes observed by the researcher at the near location. The focus of the observations was on teacher behaviors (in regards to instruction and interaction) and student engagement. A detailed description of the physical layout of the classroom was also made. The interviews followed the observations and were designed as a conversation between the researcher and teacher. Open-ended questions were organized around a few key topics that were driven by the research questions, the literature and the observations. The interviews lasted 20–30 minutes and were recorded with a digital audio recorder. Due to geographical distance and other limitations, the sixth teacher was only interviewed by telephone. The data were transcribed and manually coded and then inductive analysis and cross case comparison were used to discover patterns and themes. In-depth analysis of these six cases was used to answer the research questions posed by the study.

Data analysis
For this study, data analysis was based on Miles and Huberman's (1994) framework: data reduction, data display, conclusion drawing and verification. All identifiable names and information were stripped from the data and stored separately in the researcher's office. The research questions were used to focus the data analysis and to filter out extraneous information. Field notes from the observations and transcribed interview responses were coded using some codes that were determined a priori (based on concepts in the literature, as discussed above) and some which subsequently emerged from the data. Participant checking was conducted through a follow-up email of the transcription. The experiences of the teacher-participants and the individual contexts in which they operated were compared and contrasted. The final step of the data analysis was to return to the research questions and use points of consistency and recurring themes to synthesise themes, based on teachers' responses to the questions.

Results and discussion
The research questions guided the analysis, allowing us to unpack the elements of videoconferencing that the participants believed impacted the effectiveness of their instruction and to discover how these elements could be overcome. Using data from teacher interviews and classroom observations, we identified the following challenges that dominated the experience of teaching by videoconference: (1) insufficient time, (2) feelings of isolation, (3) scheduling and logistics, (4) unreliable technology and (5) limited personal connection.

Insufficient time
All the participants reported that teaching by videoconference required more time than face-to-face teaching because it involved more complex planning, preparation, and professional development. This finding has been reported numerous times in the past (Schiller & Mitchell, 1992; Fitzgibbon, 2003; Furst-Bowe, 1997). Despite the research that supports it, none of the teachers in this study were assigned extra time for their roles as videoconference teachers, which they felt had an impact on their ability to plan effective lessons, give prompt feedback, manage the course and explore professional development opportunities. In a face-to-face class, a teacher is often photocopying material at the last minute, creating impromptu activities, and developing the lesson plan as they go. However, this type of approach does not work in a videoconference course. For example, to get resources into the hands of their remote students in time for the lesson, teachers need to upload them to a website or learning management system, or email them to a teaching...
assistant (who then photocopies and distributes the materials), or hand deliver them to a "carrier," tasks that need to be completed well in advance of the lesson.

Extra time is also required to explore ways to better use the technology for effective instruction. While almost all the teachers were given rudimentary preparation in advance of their first videoconference course, this training mainly focused on how to operate the equipment and software. Scant guidance was offered in terms of the pedagogy required to teach effectively by videoconference. Instead, the teachers interviewed were left to discover effective pedagogical practices for themselves in their own time. Teacher F commented, "I am so busy that I don't have time to explore new ideas so I just keep doing the same thing, which I know isn't the best." Without adequate time to plan and prepare, Teacher F reverted to lecturing, an approach that researchers caution against due to its lack of interactivity (Anderson, 2008a). This behavior is commonly reported in the literature (Alberta Education, 2006; Verduin & Clark, 1991). While most of the teachers used lecturing as their primary instructional approach, they were all aware that videocferencing technology had the potential for more constructive pedagogy, interactivity and learner-centeredness but lacked the time to prepare accordingly. This aligns with the conclusions from a study that was conducted on student perspectives; that is, video conferencing teachers need to learn and adapt to new learning techniques using this technology (Doggett, 2008). Teacher C admitted to borrowing time from her other responsibilities to prepare for her videoconference class which allowed her to create lessons that regularly switched back and forth between direct instruction, independent book work, and collaborative activities. She conceded that if she had a regular teaching schedule, she would not have the time to prepare for the same amount of interactivity. We observed that her students worked on-task more often, regularly asked questions and sat more attentively during the videoconference compared with the students of teachers who simply delivered a block of direct instruction. This study confirmed what is reported in the literature about teaching with synchronous tools such as videocferencing—teachers need to be assigned more time than if they were teaching a regular face-to-face course (Roberts, 2009). The findings of this study suggest that teachers are not receiving sufficient time to plan, prepare and execute these classes effectively, or to develop new pedagogies that are more appropriate to the medium, even though the literature points to these factors as necessary for good videoconference teaching.

Feeling isolated

The majority of participant teachers reported feeling isolated in their role, both geographically and collegially. Even those who were teaching from a large urban high school felt that no one else understood what it was like to teach by videoconference. In Alberta, there is a rural conference each year but finding the time to attend was often a challenge. Several of the teachers expressed a desire for more professional development and collaboration. This was made clear in the following comment: "We are very isolated. I would love to do more information sharing with other VC teachers but we don't have enough time" (Teacher B). On rare occasions, the participants in this study would contact a fellow videoconference teacher by phone or email but this did not seem to lessen the feelings of isolation. The opposite of isolation is what many researchers refer to as social presence, or the feeling of togetherness despite being apart (Gunawardena, 1995; Lombard & Ditton, 1997; Rourke, Anderson, Garrison, & Archer, 2001). While work has been done by these researchers to determine how social presence can be developed across a screen using immediacy behaviors and communication strategies, unmediated face-to-face situations are still considered the gold standard (Hauber, Regenbrecht, Hills, Cockburn, & Billinghurst, 2005). Unfortunately, video conference teachers rarely connect face-to-face to share strategies and discuss best practices. Most teachers were not even aware of the extent to which video conferencing was going on in the province.

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In addition, there is limited research and very few resources available on videoconference delivery which was one reason why all six participants cooperated so enthusiastically in this study. This lack of practical pedagogical support intensified feelings of being alone in their work. A comprehensive literature review on videoconferencing confirms this perception that research is thin (Lawson, Comber, Gage, & Cullum-Hanshaw, 2010). When asked where they found support, Teacher C said, “I literally do an internet search for <videoconferencing> but there is not a lot that comes up.” The onus was on each individual teacher to find specific videoconference professional development opportunities or resources, and engage with fellow colleagues. In all the cases, teachers reported a shortage of time to initiate conversations with fellow videoconferencing colleagues, to attend conferences and to search for resources. The researchers investigated the options for professional development that focused specifically on videoconferencing and found no resources on the government website or workshop opportunities at the annual rural conference. The teachers were confused about why the government would spend so much money to put the infrastructure in place, but then abandon them to figure it out in isolation.

Scheduling and logistics

Synchronous videoconferencing is temporally dependent (Murphy et al., 2011) as multiple sites need to come together at exactly the same time with little flexibility. In the cases studied there were often inconsistencies in school breaks, timetables, and school-wide extracurricular activities. This concern was reported by all the teachers except for Teacher A, whose school district uses videoconferencing exclusively and intentionally for delivering high school courses. The issue of schedule inflexibility was highlighted in a meta-analysis of distance education studies (Bernard, Abram, Lou, Borokhovski, Wade, Wozney, et al., 2004). Administrators in Teacher A’s school system were united in purpose, and they aligned timetables and schedules to accommodate videoconferencing. The other five teachers did not have this support. Teachers D, E and F, in particular, had to teach their face-to-face students on Friday while their remote peers had the day off. In addition, the spring breaks of the two schools did not align. Teacher E commented that, “The biggest problem we have is scheduling. There are so many disruptions to the normal schedule. Like this semester, there were three weeks when we were not in class together. And that’s not including all those Fridays.” Echoing similar concerns about scheduling, Teacher C reported:

It is really hard to juggle things when one of the schools has a school field trip. You will see I was a little off today because one group was gone Tuesday last week and another group was gone Friday. We are not all at the same place in the curriculum.

Cross-case analysis suggested that videoconference teachers felt supported when the entire school district made scheduling a priority, such as in Teacher A’s case. However, more often teachers were left to find creative ways to adjust their teaching to misaligned field trips, days off and vacation times.

In addition to scheduling concerns, teachers talked about the logistics of managing a course with remote students. For example, the flow of formal assessments and feedback was often a tedious process involving scanning, emailing, printing and distributing. One teacher talked about having to use a third-party to hand carry tests and projects back and forth across the 150 km distance. In five of the six cases studied there was an onsite assistant with the remote students. This person was observed doing various tasks such as classroom management, communicating with the teacher about students’ progress, tutoring students, distributing resources, and handling the organization and logistics of the classroom on the other side of the screen, which matches what Borup and Drysdale (2014) reported in their work on the role of the “other” in K-12 online and blended courses. The teachers interviewed were adamant about emphasizing the critical role this support person plays in the success of videoconferencing, confirming existing literature on the

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topic (Barbour & Adelstein, 2013; Barbour & Mulcahy, 2004; Bower et al., 2014; de la Varre, Kane, & Irvin, 2010; Hedestig & Kaptelinin, 2005; White, Ramirez, Smith, & Plonowski, 2010). Teacher C noted that she had “a system where the assistant sends me student work every day,” and Teacher E commented that she “could not survive without the teaching assistant over there. We talk a few times a week.” In the cases studied here, the role of onsite assistants was not formally defined but they were described as being “on-hand” and the teachers found them invaluable. De la Varre et al. (2010) formalized the role of the onsite assistant in their study on K-12 online distance learning and suggested that the responsibilities for ensuring student success should be distributed between the teacher and the onsite assistant. In the New Zealand system, there is a VC Coordinator assigned to liaise with stakeholders, organize supervision for assessments, and ensure access to materials, but they do not provide actual learning support and this has shown to diminish the experience for students (Roberts, 2009). A more learner-centered environment could be created when the distance teacher and onsite assistant work together to support students and their learning.

Unreliable technology

Every teacher in the study made comments about the quality of the technology. While all agreed it was adequate, there were occasional problems. Technological interruptions have been shown to create a feeling of distance between communicators (Anderson et al., 2003; Karal et al., 2011), and this concern was echoed in the study. When asked about changes that would improve their videoconference teaching, all the teachers mentioned technological upgrades such as, “A camera that would move and focus on the person speaking” (Teacher B); “A system that doesn’t freeze” (Teacher C); “More bandwidth” (Teacher A) and “Better audio so it does not feel like we are using a CB radio” (Teacher D). All of the teachers interviewed were unimpressed by the technology but they were frustrated whenever they had technical issues. They hoped not only for reliability, but also for better equipment to improve image resolution and audio quality.

While it is clear in the literature that pedagogy is more important than technology (Murphy et al., 2011), the technology needs to be “suitably and properly deployed” (Greenberg, 2009, p. 7) and integrated with the appropriate pedagogy (Maor, 2008) in order not to interfere with learning outcomes. Having reliable technology means that teachers can focus their energies on the pedagogical strategies needed for effective teaching and learning. Other studies have shown that technical interruptions impact student satisfaction (Doggett, 2008; Karal et al., 2011; Peterson, 1999) with some suggesting that a technician be placed at each site that can troubleshoot issues. Technology is always improving and so many of these issues will be mitigated with time. However, it is important to note that a minimum level of functionality is required in order to alleviate teacher frustrations and protect the time that teachers need to focus on developing new pedagogical paradigms (Follett & Pratt, 1999) and finding ways to develop effective relationships across the screen.

Limited personal connection

Even though the teachers interviewed were geographically separated from their students by at least 100 km, they all indicated a desire to connect with them face-to-face at least once during the semester. The teachers who physically visited their remote students described how this helped develop rapport and build relationships between students who were otherwise isolated from each other. This confirmed findings by Bernard et al. (2004) and Karal et al. (2011) who found that opportunities to communicate face-to-face benefit students in synchronous videoconference courses. The school district where Teacher A works had taken this aspect of videoconferencing seriously, and implemented purposeful relationship building activities that involved getting all the dispersed students together in one location at least twice per semester. Teacher A reported that
the students were often texting one another at lunch time during the semester because relationships had formed during these meetings. The other teachers had to initiate and manage opportunities to connect with students. and despite research that suggests it is the teacher’s role to do so (Anderson et al., 2003), the participants in this study did not feel they had the administrative support for such endeavors.

Beyond bringing students physically together, we also investigated social connection across the screen (“presence”). Presence gives participants who are geographically separated the feeling of “being there” and “being together,” and we agree with Moore (1993) that distance education teachers have a responsibility to create this condition. In this study, each teacher was asked what strategies they employed to connect with their students and to bridge the physical distance. They all agreed that it was more difficult to form positive, affirmative relationships in a videoconference context than in a face to face classroom. Opportunities for informal conversation and interactions, such as what normally occurs in the hallway or playground, were rare. Teacher A, however, offered some strategies that she used to successfully mitigate this challenge. Firstly, she preferred to refer to herself as a “telepresence” rather than a videoconference teacher. She explained that “telepresence” puts the emphasis on being present with students (in contrast to just teaching at them). This suggests a pedagogical paradigm shift in which teachers use the affordances of the technology to connect, communicate and “come alongside” students rather than just broadcast lessons. In other words, it means the videoconference teacher should focus less on teaching and more on learning (Nuthall, 2005). Secondly, during a live videoconference class, Teacher A “overcompensated” for her remote students by teaching directly to the screen (instead of to the students who are face-to-face) to mitigate the sense they often had of being audience members. Teachers D, E and F, who all taught face-to-face students and remote students at the same time, did the opposite. That is, they taught to their face-to-face students and only occasionally addressed their remote students directly. It should be noted that, when compared to the other five participants, Teacher A seemed to have the highest degree of satisfaction and enjoyment as a videoconference teacher and explained that she preferred to teach this way because it afforded her the chance to create more interactive and engaging lessons. Without this paradigm shift from course delivery to student engagement and inquiry, Teacher A believed that videoconferencing was in danger of being what Bernard et al. (2004) describe as a “poorer-quality replication of classroom instruction” (p. 408).

Conclusion and recommendations
Course delivery by videoconference improves opportunities for remote and dispersed students who would otherwise not have access to specialized teachers. As connectivity improves, cost of equipment decreases and human resources are stretched, we believe that the use of videoconference technology in education will continue to expand. Supporting the teachers who work in this specific K-12 distance education context is critical and this study aimed to understand the challenges and affordances of the technology and the subsequent implications for practice. Through teacher interviews and classroom observations, the leading challenges facing teachers using real-time videoconferencing were identified as insufficient time, feelings of isolation, poor logistics and scheduling, unreliable technology and limited personal connection between teacher and students. However, we also noted some ways that the participant teachers mitigated these challenges and synthesized these into the following three recommendations for future practice.

Leverage supporting tools
All the teachers used various communication tools to support their teaching by videoconference and mitigate some of the logistical and interactivity issues. For example, Teacher A reported that she was a “heavy user” of Moodle (a learning management system) to store lessons and resources
for her students. Her school district had also adopted Google Drive applications, which she used to “look over the shoulder” of students as they worked. Teacher C relied on texting and email to communicate with her students in and out of class, noting that they often sent images of schoolwork to each other for checking or seeking assistance. To help students get to know one another, as well as to share information for projects, Teacher D adopted Google+ Communities. Teacher E used a class website to host resources instead of constantly photocopying everything, and Teacher F opened a live chat during class so his remote students could ask questions “in private” without it being broadcast publically over the videoconference. These are some examples of many tools available that teachers can use to support the videoconference classroom and which Anderson (2008a) suggests is necessary for effective distance programming. Alberta Education (2006) also reported that videoconferencing technology alone provides only a relatively limited set of interactions and should be enhanced with other networked learning tools to increase educational efficiency, and all the teachers in this study would agree. We recommend that teachers who teach by videoconference employ additional technological tools (synchronous and asynchronous) to improve interactivity, develop interpersonal connections and mitigate the logistical challenges that were identified in the study.

**Intentionally build presence**

Teacher A and C were the most successful in mitigating the impact of distance on the personal connection with and between their students. Teacher A overcompensated for the remote students by greeting them first, teaching to the camera, and prioritizing their questions. Teacher C took the extra time to design interactive tasks for her students and find creative ways to engage them beyond the lecture. The teachers who were reverted to just delivering content across the screen and who treated their remote students as audience members to their own face-to-face class reported more frustration with the videoconference, citing lack of connection as a major factor. We recommend that teachers create intentionality around the development of presence by designing interactive lessons rather than just delivering lectures, and by leveraging the affordances of the technology to forge connections with remote students. This will help mitigate the challenge of presence in the videoconference class.

**Prioritization by the administration**

This study showed that administrative support is critical for teachers to be successful in their videoconference delivery. One of the teachers in the study worked for a school district that prioritized videoconferencing which ensured that schedules were aligned, necessary equipment was kept upgraded, and dispersed students had the opportunity to physically get together regularly with their teacher. With this support behind her, this teacher believed that videoconferencing was the best way to educate her rural students and this was reflected in her enthusiasm and positive attitude. In contrast, the other five teachers believed that videoconferencing was better than the alternative (ie, independent learning) but not ideal. We recommend that school administration provide videoconference teachers with the extra planning, preparation and professional development time required to teach effectively. In addition, this study shows that resources should be allocated to help teachers connect face-to-face with their students at least once during the course. Technology issues were also raised as a challenge for videoconference teachers, impeding effective lessons and exaggerating the distance between instructor and student (Anderson et al., 2003). It is recommended that technical support be made a priority for videoconference teachers, which includes troubleshooting equipment bugs, technical training, and a commitment to improve and upgrade resources as necessary. When the administration prioritizes the videoconference programming in school division, we suggest that the problems of time, technology, scheduling and feelings of isolation will be lessened.

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With the advance of the technology, concentrated effort should be made to train teachers to become more comfortable with videoconferencing and increase their awareness of their students’ needs. Accordingly, this should improve their pedagogical practice in this new technological space. In order to support this training, future research should focus on how to improve practices that meet the needs of district initiatives and develop greater understanding of the potential of videoconferencing to create communities of inquiry and independent learners. As shown here, it is possible to alleviate the various challenges implicit in the video conference context and create interactive and effective learning environments for students when teachers leverage additional technological tools to build community, intentionally develop presence through interactive pedagogy and receive support from administration for time, professional development and scheduling.

**Statements on open data, ethics and conflicts of interest**

This study has been approved by the Murdoch University Human Research Ethics Committee (Approval 2013/067). All ethical guidelines as listed in the National Statement on Ethical Conduct in Human Research have been upheld. Data have been anonymized and coded and is stored by the investigators at Murdoch University. There is no conflict of interest in the work that has been reported.

**References**


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Navigating challenges of videoconference


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Paper 3 - The unique skills required of videoconference teachers in high school distance education courses: Implications for training and professional development

Research Aim

The aim was to combine qualitative data about the skills that the participant teachers required to teach successfully in a videoconference with the findings from previous studies to formalize the skill set according to role. The findings from this study have implications for the training and professional development of videoconference teachers rather than leaving them to figure it out alone. Two more teachers were added to the participants for this study as they had learned of this research and expressed a desire to be active members of developing support and resources for videoconferencing.

Research Questions

1. What unique skills do K-12 videoconference teachers require to create a successful learning environment for distance students?
2. What are the implications of the above for teacher professional development?
The unique skills required of videoconference teachers in high school distance education courses: Implications for training and professional development

Abstract

The purpose of this research is to identify the unique skills required of videoconference teachers who teach high school courses across a geographical distance. Many schools and educational districts worldwide are using videoconference technology to deliver courses to students as an economic solution when they cannot afford specialized teachers at remote locations. However, teachers are not trained for this work and are asked to rely on standard classroom training and experience to translate into the new setting. The collective case study used observations and interviews of eight teachers across five schools to identify the skills required to teach in a way that they perceived as successful in a videoconference class. It was found that teachers are largely under-prepared for the requirements to project presence, develop relationships, foster interaction, manage the course, and teach content across a distance when the screen is the main tool of connection. We offered a path to improvement that involved supporting action research, creating communities of inquiry, and developing teaching quality standards.

Key Words: videoconferencing; distance education; instructional technology; K-12; teacher roles

Introduction

Videoconferencing is used by distance education providers across the world as an alternative to fully online courses and traditional distance education programming in K-12 schools. For example, the Correspondence School in New Zealand (Roberts, 2009), along with the New Zealand Virtual Learning Network (Barbour & Bennett, 2013), offers an increasing number of courses by videoconference to its senior students. Similarly, the School of the Air in Australia has begun switching from audio to video-based platforms (Vize, 2014). Videoconferencing has pervaded K-12 education in the UK for the last two decades (Videoconferencing for Global Learning, 2015), and in the United States, students in Nebraska are being taught music by specialized teachers in New York across the videoconference screen (McFarland, 2013). The Canadian province of Newfoundland and Labrador has been engaged with synchronous delivery of high school courses to rural students using both audio and video since 1988 (Barbour, 2015); and, in the province of Alberta a number of rural school divisions are leveraging extensive internet coverage to connect remotely distributed students through videoconferencing technology (Alberta Education, 2012; Anderson, 2008). In almost all these cases, class sizes are too small to warrant secondary teachers at each school, so multiple schools are joining together by videoconference to form larger, more viable classes and to share teachers. Six percent of Canadian students are taking courses by distance education (Barbour and Labonte,
2014), and the majority of these are fully online and/or involve independent study. However, proponents of videoconferencing suggest that live synchronous delivery is superior to asynchronous methods because it enables immediate interaction between learners and teachers (Offir & Lev, 1999), increases rich interpersonal communication (Smyth, 2005), creates social presence (Nippard & Murphy, 2009), and gives more opportunity for teacher immediacy behaviours (Alberta Education, 2006; Park & Bonk, 2007). For these reasons, school systems worldwide are turning to videoconferencing as an important part of distance education solutions.

While these claims sound promising, the findings from a literature review of videoconferencing found that the research supporting them is under-developed (Lawson, Comber, Gage & Cullum-Hanshaw, 2010). Without research to support pedagogy associated with videoconferencing, teachers are left without adequate advice, training and resources. They revert to the instructional strategies they have always used in their classrooms (Anderson, 2008; Andrews & Klease, 2002) even though videoconference instruction requires unique teaching methodologies (Schiller & Mitchell, 1993). For this reason, teachers are left unprepared for the task of effectively delivering courses across a screen to a dispersed population of students. In this paper we present the results of a qualitative study that addressed these issues by identifying the unique skills that K-12 videoconference teachers require in order to successfully teach a distance course delivered by videoconference. These results can inform training and professional development for current and future videoconference teachers.

**Literature review**

Education institutions only began employing videoconference technologies to deliver courses in the 1990s, mostly in higher education (Lawson et al., 2010). The technology at the time did not afford high quality audio and video but in the years since, videoconferencing specific technology and connectivity have rapidly and significantly improved. Unfortunately, the research into videoconferencing pedagogy has not kept pace, particularly in K-12 settings.

Originally, videoconferencing was used to deliver lectures to large numbers of dispersed students at the post-secondary level. It was shown to be a cost-effective way to provide distance education (Bates, 2005) but it was soon found that the overall learning experience was not as good for remote students as it was for face-to-face ones when teachers just lectured (Gilles, 2008). Many researchers argued that new teaching methodologies should be employed (Andrews & Klease, 1998; Burns, 2002; Mason, 1994; Smyth, 2005) but few practical suggestions, beyond the vague notions of ‘interaction’ and ‘student-centred learning’ were offered. These studies provide only limited insight into the unique skills required of videoconference teachers and they are almost exclusively focussed on post-secondary education. While some of the theory is useful as a starting point for understanding K-12 contexts, for reasons first identified by Malcolm Knowles (1980), K-12 warrants its own study.

While there has been little research conducted to identify the unique skills required of a K-12 videoconferencing teacher, there is a growing body of work about the roles of online and/or asynchronous teachers, particularly in higher education (Lui, Bonk,
Magjuka, Lee & Su, 2005; Maor, 2003). Much of this research uses Berge’s (1995) model of instructor roles as a framework for investigating online teaching: pedagogical, managerial, social and technical. These distinctions are helpful for categorizing the skills that the K-12 videoconference teacher requires to create successful learning communities and were used in this study as a framework for organizing data.

Much of the support for K-12 online teachers is being driven by the North American Council for Online Learning (www.iNACOL.org), an organization in the U.S. iNACOL has published standards and guidelines for online teachers but they lack empirical support (Rice, Dawley, Gasell & Florez, 2008), and little attention is given to the unique situation of distance educators who provide courses by fully synchronous videoconference. While videoconferencing teachers can draw some helpful information from these resources, this is limited because videoconferencing sits somewhere in the divide between online and face-to-face. In other words, it somewhat resembles a face-to-face class, except for the fact that the teacher is not physically there, leaving communicative technology and online platforms to mediate the gap.

Newfoundland, Canada, is a province that uses videoconferencing, among other synchronous technologies, to reach its greatly dispersed K-12 student population and some small studies have been conducted over the last decade. Findings show that: (a) synchronous communication, such as videoconferencing, helps teachers create a learner-centred environment (Murphy and Rodríguez-Manzanares, 2009); (b) teachers need professional development on the tools in order to use them effectively (Murphy and Coffin, 2003); (c) time and resources are necessary for videoconference teachers, especially those who teach face-to-face and remote students simultaneously (Murphy, 2010); and (d) that pedagogy is more important than the media (Murphy, Rodríguez-Manzanares & Barbour, 2011). While these studies largely focused on the teacher, they do not specify the unique skills teachers require to teach successfully in a videoconference, the result of which is lack of training and teacher preparedness. This study contributes to filling that gap.

Specifically the following questions were examined in this study:

1. What unique skills do K-12 videoconference teachers require to create a successful learning environment for distance students?
2. What are the implications for professional development and training?

Methods

Design

This research used a collective case study approach (Stake, 1995) to observe and inquire about the experiences of videoconference teachers delivering courses to remote students in the K-12 system in Alberta. The focus of the observations and interviews was on the tasks that the videoconference teachers were required to do in order to achieve perceived success in this context. Teachers were also probed about what they counted as successful teaching.

Eight teachers from three rural school divisions in Alberta, Canada, participated in this study. Their names were put forth by their respective division administrators and a
letter of invitation with information about the study was emailed to those nominated. All eight teachers agreed to participate in the study, citing a desire to improve their practice. These eight teachers had varying levels of experience teaching in a videoconference context and taught a variety of subjects and levels ranging from 7th to 12th grade. Two of the eight teachers taught only remote students, whereas the other six had students simultaneously in front of them and on the other side of the screen during the videoconference. All the schools were using Polycom® videoconferencing suites with SMART™ interactive whiteboards and Bridgit™ screen connecting software. The teachers were all using additional communication platforms to support course delivery such as email, texting, Google Drive™, and/or Moodle™.

Data collection and analysis

The participants were contacted at least twice during the study. The first was by email to arrange formal consent, set up interview times, and answer any questions they had. The second contact involved visiting them at their school, observing at least one of their lessons, and conducting a 30-minute semi-formal interview. Field notes were kept during the observations, as well as noting items that needed clarifying in the follow-up interviews. Interviews were digitally recorded and transcribed. The interviews were guided by the following inquiries:

- What outcomes would provide evidence of successful videoconference teaching?
- What special skills does the videoconference teacher need?
- What training did you receive for this role?
- What challenges and barriers do you face?

Data analysis was based on Miles and Huberman’s (1994) framework: data reduction, data display, conclusion drawing, and verification. The data contained in the field notes and interviews were reduced using the research questions as a guide. The participants’ responses were then coded so they could be grouped according to repeatedly present skill sets for teaching by videoconference. These skills sets were then sorted according to Berge’s (1995) role dimensions for online instruction in order to formulate a clear picture of the work of a videoconference teacher. The data were collected from eight teachers, located at five different teaching sites and representing three different districts. The participants’ responses were triangulated with the classroom observations to ensure credibility.

Findings

The data revealed the following key findings: (a) successful teaching by videoconference requires teachers to master a complex mix of technical, pedagogical and interpersonal skills, including: to communicating across a 2-dimensional screen, forging relationships with students through technology-mediated interaction, developing teacher presence, championing the technology within the community, and designing courses that leverage the affordances of the medium to foster deep inquiry and student engagement; (b) teachers felt underprepared and untrained for the role of videoconference teacher and would welcome support through action research, professional collaboration, and specific pedagogical training.
During the one-on-one interviews, participants were probed about what they considered successful teaching in a videoconference and they consistently responded with the following identifiers: enjoyment of teaching, opportunity to experiment new instructional strategies, student engagement, deep and meaningful learning, student independence, achievement on external exams, community buy-in to videoconference program, relationship with students, student-to-student interaction, and minimal technical interruptions. These identifiers are not necessarily unique to a videoconferencing context, but follow-up discussion revealed that even the most enthusiastic teachers felt they were falling short of one or more of their desired outcomes and admitted that there was room for improvement. When probed about what contributed to this struggle, all the teachers pointed to barriers that were beyond their control (geographical distance, inadequate time and money, technical limitations), but they were also able to identify areas in their own practice that needed development, which is why they volunteered for the study in the first place. Collectively, they felt the following things were within their control to improve, given the right training and conditions (see Table 1):

Table 1: Overview of the Findings.

<table>
<thead>
<tr>
<th>Areas for Improvement</th>
<th>Number of teachers who identified it</th>
<th>Exemplars</th>
</tr>
</thead>
<tbody>
<tr>
<td>Understanding how to use social media and other technologies to connect with students.</td>
<td>4</td>
<td>“My students text photos of their work to me when they have a question. They always have their phones on them anyway and this is a really quick and easy way to communicate back and forth. Sometime they send me a non-study related message which can seem a bit too personal so I always steer the exchange back toward a work question.” (Teacher A) “I try to keep my eye on the school website news updates so I am aware about what is going on in the lives of my remote students. That way I can ask them about a volleyball tournament or something like that.” (Teacher B)</td>
</tr>
<tr>
<td>Teaching across a screen in an engaging and effective way, knowing the 2D image would lack the multisensory inputs of a face-to-face interaction.</td>
<td>8</td>
<td>“I try to be super animated and enthusiastic, but I don’t know what I look like on the other side of the screen so maybe I am distracting?” (Teacher B) “I always teach to the camera rather than the students in front of me. And you have to remember to look at the camera and not the screen. It doesn’t feel like I am making eye contact from my end, but it means I am looking right at my students at their end.” (Teacher G) “It is hard to detect emotion on the other side of the screen because they are so iddy-biddy on my screen. I have to look for obvious cues.” (Teacher A). “I have to adapt lessons for VC because some activities just don’t work across a screen. Tasks must have simple instructions.” (Teacher B)</td>
</tr>
<tr>
<td>Employing strategies to make remote</td>
<td>4</td>
<td>“Joking around with my students really helps. I try to make time for just chit-chat” (Teacher H).</td>
</tr>
<tr>
<td>Students seem “real”.</td>
<td>“I keep a list of all their names so I make sure I call on each student at least once each class.” (Teacher A)</td>
<td></td>
</tr>
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<td>----------------------</td>
<td>-------------------------------------------------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>Developing relationships with remote students and their families or guardians.</td>
<td>“I would like the opportunity to connect directly with parents, but we don’t have access to their emails because they are in a different school. Our systems are not connected like that. I guess I could ask the kids to ask the parents to give them to me.” (Teacher D)</td>
<td></td>
</tr>
<tr>
<td>Developing relationships with remote students and their families or guardians.</td>
<td>“VC classrooms require more trust so that your students will be motivated to learn and do the work even though you are not right there.” (Teacher H)</td>
<td></td>
</tr>
<tr>
<td>Developing relationships with remote students and their families or guardians.</td>
<td>“I communicate with parents an awful lot. More than usual. I don’t ever see them in person so I send a lot of emails.” (Teacher A)</td>
<td></td>
</tr>
<tr>
<td>Planning and organizing ahead of class-time.</td>
<td>“You have be super super [sic] organized because you have to get all your stuff to people and online all in advance. You can’t do anything last minute” (Teacher B)</td>
<td></td>
</tr>
<tr>
<td>Planning and organizing ahead of class-time.</td>
<td>“I try to have everything up on Moodle at the beginning on the week.” (Teacher C)</td>
<td></td>
</tr>
<tr>
<td>Planning and organizing ahead of class-time.</td>
<td>“The students are not necessarily comfortable with the technology at the beginning. The students who have had classes by VC before are better at interacting because they get used to it.” (Teacher I)</td>
<td></td>
</tr>
<tr>
<td>Planning and organizing ahead of class-time.</td>
<td>“We have experimented with introducing the younger children to VC so that when they have to take a class this way in high school, they are more comfortable.” (Teacher G)</td>
<td></td>
</tr>
<tr>
<td>Helping students to feel more comfortable with the technology.</td>
<td>“This takes time to plan. I would love to more interesting things but I tend to just lecture.” (Teacher E)</td>
<td></td>
</tr>
<tr>
<td>Helping students to feel more comfortable with the technology.</td>
<td>“The reality is that I have 27 students in front of me and just 5 that join by VC. I really just teach to them and they sort of just visit. If I had less home students it might be different and we could do labs and projects.” (Teacher C)</td>
<td></td>
</tr>
<tr>
<td>Designing learning tasks and activities that foster student inquiry, construction of meaning and deep learning.</td>
<td>“I wish my remote students would connect with my face-to-face students. I asked the administration to invite them to a school spirit event we were hosting but nothing came of it. This would have really helped build community.” (Teacher D)</td>
<td></td>
</tr>
<tr>
<td>Designing learning tasks and activities that foster student inquiry, construction of meaning and deep learning.</td>
<td>“You have to really find ways to get the students to talk to one another. I use group project across sites.” (Teacher I)</td>
<td></td>
</tr>
<tr>
<td>Designing learning tasks and activities that foster student inquiry, construction of meaning and deep learning.</td>
<td>“My courses are focused a lot on discussion and the ability to share ideas with each other. I get students to select the next reader/speaker from another site. This way they are encouraged to build relationships with other students across the screen.” (Teacher H)</td>
<td></td>
</tr>
<tr>
<td>Encouraging student-to-student interaction across screens and sites.</td>
<td>“I never really know if they understand the material or not because they don’t ask questions. They don’t always do well on their tests so they obviously don’t understand as well as my face-to-face students. It is frustrating.” (Teacher E).</td>
<td></td>
</tr>
<tr>
<td>Monitoring student progress.</td>
<td>“The students are not necessarily comfortable with the technology at the beginning. The students who have had classes by VC before are better at interacting because they get used to it.” (Teacher I)</td>
<td></td>
</tr>
<tr>
<td>Monitoring student progress.</td>
<td>“We have experimented with introducing the younger children to VC so that when they have to take a class this way in high school, they are more comfortable.” (Teacher G)</td>
<td></td>
</tr>
</tbody>
</table>
Beyond some basic training into the technical operation of the technology, none of the teachers in the study had received training in the unique pedagogical skills required for teaching a course by videoconference. As a result, they were left to "tumble around" and "experiment" with different strategies. For example, one of the teachers was teaching a high level math course and was surprised that his students on the other side of the screen never asked questions during instruction or independent work time. He had unsuccessfully experimented with three different ways of engaging them (asking for questions, emailing, and opening a chat room) and so had given up trying. Little did he know that another videoconference teacher had been very successful at providing one-on-one support to students in a math class by dedicating one teaching block a week to tutoring and using texting for instantaneous communication. In another example, a teacher was trying to unify his face-to-face and remote students in order to foster a single class community. He set up a Google Hangout and had students post biographical information for each other to read; however, only a few participated. Another teacher in a different division was trying to achieve the same outcome of building a sense of community, but he used a different strategy: he required that all students, regardless of whether they were face-to-face or remote, receive documents and submit assignments online in a Moodle platform. This created a shared
experience and united the distributed students with the face-to-face students into a single class.

Despite a common desire to improve, it was the clear that teacher participants were operating in silos and thus felt isolated in their pursuit of resources and best practices. The eight participants represented five different schools and three different divisions that were dispersed over hundreds of kilometers and they rarely had the opportunity to speak with one another or meet for professional development. When asked if they leveraged the conference equipment to meet virtually, they consistently reported that nothing formal or regular was organized, mostly because teachers were busy and there was no precedent for teachers meeting across districts. In fact, most of the participants were unaware of how videoconferencing was being used elsewhere in the province. One of the participants is both a principal and teacher, and indicated that he is trying to lead the improvement of videoconferencing in his school division by bringing teachers together:

I have just started trying to have regular virtual meetings with all the videoconference teachers in our division. This year we have nine teachers at three different campuses with three different school cultures, so I am trying to get everyone on the same page, to build a monoculture, to have some consistent standards for VC teaching across all courses. It is difficult because I can encourage my teachers to improve their practice, but I have no authority over the teachers at another school, even though they teach my students via VC. Not everyone agrees with videoconferencing but I think it has great potential. We need training, resources and research; and, we need to learn from each other. (Teacher F)

The focus of this study was on skills for teaching specifically by videoconference in order to provide a framework for much needed training and professional development. We developed this framework around teacher roles. While all teachers, whether in a face-to-face class, a videoconference, or fully online course, fulfil pedagogical, managerial, social and technical roles (Berge, 1995; Maor, 2003), the emphasis on certain roles and the skills required to accomplish those roles varies between contexts. After identifying the skills that teachers felt they needed to improve from the study’s data, these skills were then sorted into Berge’s role categories. This classification system is well established in the literature in regards to the roles of online teachers, but due the shared experience of ‘teaching-at-a-distance’, it can be extended to consider the roles of videoconference teachers as well. Table 2 provides the results of that sorting.

Table 2: Skills According to Role

<table>
<thead>
<tr>
<th>Role</th>
<th>Teachers must be able to…</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pedagogical</td>
<td>Teach and communicate content across a screen.</td>
</tr>
<tr>
<td></td>
<td>Engage students despite the limits of a 2D image.</td>
</tr>
<tr>
<td></td>
<td>Design learning tasks and activities that foster student inquiry, construction of meaning and deep learning rather than just lecture.</td>
</tr>
<tr>
<td></td>
<td>Monitor progress and give feedback.</td>
</tr>
<tr>
<td></td>
<td>Elicit and answer questions</td>
</tr>
<tr>
<td>Managerial</td>
<td>Plan and organize ahead of class.</td>
</tr>
</tbody>
</table>

64
Leverage and manage the education assistants at the far locations. Exchange learning materials across a geographical distance.

Facilitate interactions between students. Create a class community, even when students are dispersed. Attend to student emotion and mood across the screen. Build relationships with students that you never meet in person. Get parent and community buy-in. Create a sense of presence despite not being physically together. Develop a mono-culture across different sites.

Keep abreast of new technologies. Troubleshoot technical interruptions. Know how to operate the hardware and software. Train and prepare students to use the technology. Understand the impact of technology on practices and knowledge of discipline.

Discussion

The findings of this study allowed the researchers to identify the unique skills required of teachers who deliver high school courses by videoconference and group them into Berge’s (1995) role dimensions. In the following section, we will discuss the implications of these findings in light of the literature and for the purpose of guiding training and development of current and future videoconference teachers.

Pedagogical role

The pedagogical dimension refers to the duties as an educational facilitator. In studies of fully online post-secondary courses, researchers have suggested that this might include designing instruction and course structure, facilitating discussion, giving feedback, and direct teaching (Anderson, Rourke, Garrison & Archer, 2001; Berge, 1995, Lui et al., 2005). While the K-12 videoconference teacher also needs to fulfil these duties as part of the pedagogical role, different issues are raised in this context. Where fully online teachers are required to navigate the challenges of communicating instructions and discussing content in text form, the videoconference teacher is required to connect students to content and explain concepts and processes across a screen, knowing that the 2-dimensional image lacks the multi-sensory cues of a face-to-face exchange. Teachers need to consider how their projection is received by the remote students; whether it appears that eye contact is made, whether the tone of voice is warm and engaging, and whether they are close enough to the camera for students to see facial expression and emotion. Aydin (2012) found a positive relationship between learners’ perception of ‘social attractiveness’ of the instructor and their perception of the content of the course which suggests that the projection of the instructor across the screen is important. In this way, there appears to be an element of ‘teaching as acting’ (Griggs, 2001) implicit in a videoconference course. The performance aspect of teaching is rarely raised in education circles, but some proponents believe that teacher preparation programs should include basic training in acting (Javidi, Downs & Nussbaum, 1998; Sarason, 1999), and based on the findings, this suggestion seems even more significant for videoconference settings.
Constructivist notions of learning suggest that the direct teaching method is not the best way to educate students (Freire, 1996), an idea that has led current education reforms toward inquiry-based and student-directed learning. Videoconferencing, however, tends to lend itself to delivering lectures, especially in the case of high school distance education courses where students are preparing to take external exams. This was evident in the findings of this study and mentioned in the literature (Anderson, 2008, Verduin & Clark, 1991). Helping students to construct meaning and engage deeply with content requires that teachers design more authentic learning experiences that foster inquiry, monitor progress, and provide feedback. These tasks require more pedagogical skills than just lecturing, and when students are dispersed and teacher-student interaction is restricted to a 2-D screen, these skills need to be even more pronounced. Videoconference teachers need to leverage supplementary communication tools and social media to create rich, interactive learning environments for their students, a practice that is supported in the literature (Anderson, 2008).

**Managerial role**

All teachers manage their courses to some extent. This includes organizing materials ahead of time, distributing and collecting assessments, leveraging the services of an educational assistant, and managing student behaviour. The participants in this study stressed the importance of being more organized, structured and clearer when teaching in a videoconference. There is a greater risk of ambiguity and misunderstanding in communication when the teacher is not face-to-face with students (Lui et al., 2005) and so course outlines and expectations need to be well-designed in advance. It is harder to “teach-on-the-fly” in a videoconference, and near impossible to distribute materials instantly to students in remote locations, yet flexibility is seen as an important element of good teaching (Christenbury, 2011). Balancing structure with flexibility is more challenging in the videoconference. Communication with the educational assistant also has to happen across a screen (or in text form outside of the lesson), which makes it hard to address issues as they arise in private. To complicate matters, most educational assistants are not paid for preparation or follow-up time and must remain in the remote room at all times for supervision purposes. In addition, the ‘temporally-dependent’ nature of the videoconference class requires additional organizational challenges, especially when site schedules and calendars do not completely align, a problem that has been reported elsewhere (Bernard, Abram, Lou, Borokhovski, Wade, Wozney, et al, 2004; Murphy et al., 2011). The managerial role is emphasized in the videoconference when compared to face-to-face teaching.

**Social role**

It has been assumed that the face-to-face experience is closely replicated in a videoconference course by nature of just being able to see and communicate with one another over the screen (Bernard et al 2004; Short, Williams & Christie, 1976). In other words, the technology is inherently social and interactive. This study indicates that this is not the case. The biggest barriers to successful teaching in a videoconference course, according to the participants, were social ones – building relationships, creating classroom culture, getting community buy-in, developing presence, and facilitating student-student interactions. Teachers need to be highly skilled at traversing the real and perceived distance between participants in a videoconference.
course. This idea has been captured in Moore’s (1993) transactional distance theory where he suggests that reducing the perceived distance will improve learning. Munroe (1998) offers the explanation that relationship development is just as important as information-sharing and knowledge-building. The skills required to accomplish this are varied and include: attending to emotion on the other side of a screen, championing the videoconferencing in the community to get widespread buy-in and support, creating a sense of real presence, building relationships, and fostering interaction between students across sites to connect the learning spaces and create a monoclssroom culture. Student-to-student and student-to-teacher interaction has been shown to be particularly important when creating feelings of togetherness (Karal, Cebi & Turgut, 2011, Maor, 2008), which in turn leads to better student-content interactions (Anderson et al, 2001). These interactions occur more naturally in a face-to-face context, but in the videoconference require special attention and planning from the teacher.

Technical role

Technical skills are easy to operationalize – videoconference teachers need to know how to operate the hardware and software. The majority of the participants in this study had received basic technical training and were comfortable with the technology, as long as it was working. Technical interruptions have been shown to negatively impact learning in a videoconference (Anderson, 2008, Doggett, 2008) but these lie out of the control of the teacher. The school divisions made a priority of training teachers on the equipment, but helping teachers understand the impact of the technology on pedagogy and content, otherwise known as TPACK – technological pedagogical content knowledge (Koehler & Mishra, 2009), was largely ignored. While technical training is necessary, it is not sufficient when preparing teachers for videoconference instruction. They require “an understanding of the representation of concepts using technology and some pedagogical techniques that use technologies in constructive ways to teach content” (Koehler & Mishra, p. 66).

Implications and conclusion

The results from this study enabled us to answer the research questions posed. The data showed that videoconference teachers require skills that are unique from online and face-to-face teaching in order to teach in a way that they perceive as successful. The study also reported that teachers are doing their best despite being untrained and unprepared for these roles. We propose three implications of these findings: (a) videoconference teachers should be encouraged and supported in conducting action research; (b) videoconference teachers need to come together to share best practices; and, (c) a set of pedagogical standards should be developed.

Action research

All the participants indicated that they were experimenting with different instructional strategies in order to find ways to build better connections, engage learners, and improve learning. In addition, “opportunities to explore new pedagogies” was commonly listed as an indicator of successful teaching. We propose that teachers need to be encouraged and supported to formalize this process so that real gains can
be made in developing best practices in videoconferencing. Action research (or practical inquiry) is systematic and reflexive, and seeks to answer questions that arise from the practical experience of the classroom (Kemmis & McTaggart, 1990; McCutcheon & Jung, 1990). Students benefit directly because teachers are able to immediately adapt their practice as they deepen their understanding of a specific problem. All the teachers joined this study because they desired to improve their practice and wanted to find out how. Putting the locus of control of inquiry into the hands of the teachers themselves, would be an effective way to do this.

*Come together*

As mentioned in the findings, videoconference teachers across the province of Alberta almost never come together to share best practices. This study revealed that many of the individual teachers had solutions to other individual teachers’ question. The collective knowledge capital about videoconferencing pedagogy among the eight participants is higher than any one teacher could imagine; however, they currently have no opportunity to share it with one another. One of the teachers was just beginning to organize a regular meeting with his videoconferencing teachers, but there seemed to be no precedent to do any cross-district collaboration. The implication of this is that each individual district, and in many cases, the individual teachers, by nature of geographical distance, are operating in silos. The first step in raising the skills of videoconference teachers would be to bring them together in a community of practice (Lave & Wenger, 1991) so they can teach each other, brainstorm new strategies, see potential, and develop standards.

*Develop standards*

Alberta Education has a ministerial order that clearly outlines the knowledge, skills and attributes required of a licenced teacher. The Teacher Quality Standards are used to drive teacher preparation and professional development in the province, but do not address the extra skills required of those who teach across a distance by videoconference. The International Association for K-12 Online Learning has also produced a set of standards to guide the quality of teaching in fully online courses; however, with over 70 indicators, it is far too cumbersome for the purposes of videoconferencing. We recommend that based on the skills identified in this study, a set of standards be developed that are specific to this unique context to inform better training and professional development. In turn, this would support principals and agencies of accountability who are trying to raise the bar on teacher quality across school sites where it otherwise difficult to monitor.

The use of videoconferencing for course delivery in distance education will continue to grow, which in turn, will require more skilled teachers. Research, resources and training for these teachers is not keeping pace with the technology and this study sought to address this lag by identifying unique skills that videoconference teachers require to provide direction for professional development. The steps we propose are to support action research, bring teachers together in communities of practice and develop standards for teaching. We also propose further research into the influence of videoconference training on perceptions of success and student outcomes from all stakeholders: students, teachers, parents, educational assistants and supervisors.
References


Burns, J. (2002). Evaluating staff development and training models to support the implementation of videoconferencing technology in a distributed university. *Quarterly Review of Distance Education*, 3, 327–340.


CHAPTER 5 – SUMMARY OF THE FINDINGS

This section draws on the major findings of the three studies that addressed teacher and student-participants’ experiences in high school courses delivered by videoconference. Each study revealed significant findings about developing teacher presence across a screen, overcoming challenges, leveraging affordances, and developing skills for successful teaching. A comprehensive presentation of the findings is given in each of the published papers (see included). The following is a summary of those findings.

Presence across a screen

The first study addressed the first three research questions (RQ #1, #2, and #3) and sought to unpack teacher presence from multiple angles (see paper 1). Quantitative data were used descriptively to examine connections between teachers’ self-reported technological pedagogical content knowledge, their confidence, their experience, and their students’ assessment of their presence. The descriptive data revealed that both confidence and experience were more strongly associated with creating high-presence classrooms compared to technological pedagogical content knowledge (TPACK), according to student reports. This was confirmed by the qualitative data. This finding was surprising as it challenges the TPACK theory put forth by Koehler and Mishra (2009) which would suggest that teachers who are skilled technically and pedagogically should be more successful at teaching in the highly technology-mediated videoconference context. However, it appeared that teacher-participants’ sense of being educationally tech-savvy was not reflected in building presence across a screen.

When students and teachers were probed about what made them feel “connected” to their teacher (teaching presence), their studies (cognitive presence) and each other (social presence), they reported a range of teacher behaviours that Mehrabian (1981) has conceptualized as immediacy behaviours. These included uses
of names, instructor self-disclosure, and humor. In addition to using immediacy behaviours, students and teachers also mentioned the importance of informal opportunities to get-to-know each other (such as site visits and discussion forums), the use of supplementary social media tools for communication, and the importance of dedicating instructional time to elicit questions from the remote students. In the cases where teachers taught students both near and far simultaneously, far students often felt like audience members (at best) and intruders (at worst) into the face-to-face classroom. One of the teachers was able to offer a strategy to address this issue – she overcompensated for the fact that some of her students were not physically present by individually greeting them at the beginning of class, teaching to the camera rather than the students in front of her, and calling on her remote students first during instructional time. But perhaps the most significant finding about developing teacher presence was the need to carve out a ‘private space’ between teachers and individual students in the largely public nature of the videoconference. This was done successfully by one teacher who used texting to communicate messages back and forth to individual students (at their preference) both during and after the live class.

Challenges and affordances

The second study addressed the challenges that teachers face when teaching by videoconference and the ways that those teachers have navigated those challenges (RQ #4 and #5). During all the interviews, teachers and students were quick to point to the challenges of videoconferencing. Most participants believed that the videoconferencing was a better method than the alternative (traditional print-based modules and self-taught courses), but only just. Only two of the teachers really championed videoconferencing technology, believing that, when leveraged properly, it could offer richer learning experiences for students than even the “gold standard” of face-to-face instruction. They cited flexible programming, student independence, and ability to develop communities of inquiry and student-centered learning as reasons for
preferring the videoconference. But even these two advocates spoke of the challenges to achieving this vision. Five factors dominated the experience of teaching by videoconference: insufficient time; feelings of isolation; scheduling and logistics; unreliable technology; and limited personal connection. These factors are comprehensively discussed in paper 2 (see included) and summarized below.

All the teachers spoke of the extra time needed for preparation of a videoconference lesson where none was allocated. This finding aligned with much of the research into the practical aspects of videoconferencing (Fitzgibbon, 2003; Furst-Bowe, 1997; Roberts, 2009). Teacher-participants also requested time to train with the technology and explore options to adapt their pedagogy. Without any assigned time for this, teachers reverted to traditional lecturing approaches that led to the mere dissemination of information across a screen, a practice that has been shown to be ineffective (Alberta Education, 2006; Verduin & Clark, 1991).

Teachers also spoke of the isolation of being a videoconference teacher, particularly when it came to seeking professional development. In fact, most of the participants were unaware about what videoconferencing was going on in other parts of the province. An internet search will uncover very little in terms of pedagogical resources for teaching by videoconference, so the teachers also felt ignored by the government (who gave them the technology) and the research community. This was one of the reasons why they so enthusiastically volunteered for the current study.

Scheduling was also a nuisance for videoconference teachers. The nature of a live conference means that there is no scheduling flexibility. This became a problem because schools were inconsistent in their holidays, operation hours, and field trip dates, thus causing disruptions to the planned lesson. Besides the scheduling concerns and/or barriers, teachers also had challenges with the logistics of a course delivery, from passing documents back and forth, to giving feedback, managing
student behaviour across a screen, and communicating progress to parents. The on-site assistant at the remote location was an instrumental partner to the teacher in ensuring the smooth management of a videoconference course.

Unreliable technology was also a common theme when teachers were asked about their barriers. They complained of both technical interruptions and poor quality audio and video. Students and teachers were used to viewing in HD but the video quality observed in the schools was anything but high definition. In addition, most of the suites had fixed camera angles which made sustained attention difficult for students. One of the school divisions had voice responsive cameras which improved the experience for the participants; however, in those cases, there was a danger of too much camera movement during times of rapid discussion. Technical interruptions have been linked to poor teacher presence (Karal, et al., 2011) and while the technology worked most of the time, occasional camera freezing or network crashing caused anxiety for most of the teachers.

Finally, all the teachers desired to have better personal connections with their students. This is not surprising knowing that most teachers go into the profession to work with youth and to ‘come alongside’ their students’ learning journeys. They all conceded that the videoconference was providing opportunities for students who would not otherwise have them, and so they looked for ways to maximize interaction within the limited context. Bringing students and teachers physically together at least once per semester was the most commonly cited strategy but this was not always supported by the school/district administration.

Developing skills

The third study focused on the role of the videoconference teacher and the specialized professional development they require to be effective (RQ #6 and #7). One of the goals of this study was to develop a list of unique skills that videoconference
teachers need to reach a perceived level of success (see paper 3 included). The data revealed 12 areas that teachers felt were within their control to improve:

- Understanding how to use social media and other technologies to connect with students.
- Teaching across a screen in an engaging and effective way, knowing that the 2D image would lack the multisensory inputs of a face-to-face interaction.
- Employing strategies to make remote students seem “real”.
- Developing relationships with remote students and their families or guardians.
- Planning and organizing ahead of class-time.
- Helping students to feel more comfortable with the technology.
- Designing learning tasks and activities that foster student inquiry, construction of meaning and deep learning.
- Encouraging student-to-student interaction across screens and sites.
- Mentoring student progress.
- Providing one-on-one or small group tutoring when needed.
- Building community in the classroom.
- Leveraging and managing support staff.

Beyond some basic training into the technical operation of the videoconferencing technology, teachers were not given training that would support any of the above skills. Instead, teachers were left to experiment by trial and error on their own. By collecting data from multiple teachers and multiple school divisions, it was determined that individual teachers were developing competencies alone that potentially could be a benefit to all videoconference teachers. The unique skills that were identified in this study were further categorized according to Berge’s (1995) roles in order to better conceptualize the professional development and training that would be required to support videoconference teachers. While the videoconference teachers in this study
fulfilled pedagogical, managerial, social and technical roles, emphasis was given to the pedagogical and social roles due to their importance in developing teacher presence and connectedness between teachers and their students.
CHAPTER 6 – DISCUSSION AND FURTHER RESEARCH

The overarching goal of this research was to offer insights into strategies and skills that could be used to potentially improve the teaching and learning in high school courses taught by videoconference, particularly in regards to building teacher presence, by addressing the challenges and leveraging the affordances of this technology. To achieve this goal, six research questions were asked; the data collected were satisfactory in answering those questions and provided a rich overview of the videoconferencing context. The findings led to implications for practice and future research which are discussed below in light of the literature. Each publication (see included) answered a different set of research questions.

Build presence

Distance education often creates an image of students sitting at home, or in tiny classrooms in rural and remote locations, behind their computers, isolated from their peers and teachers, and working independently. However, well-accepted constructivist theories of learning suggest that students learn best when engaged in a community of inquiry (Anderson, Rourke, Garrison & Archer, 2001), in which peers and teachers play equally important roles. Feeling connected to peers and instructors in community of inquiry has been conceptualized in the literature as ‘presence’ and shown to improve both satisfaction (Jones, Kolloff & Kolloff, 2008; Shin, 2003; Witt, Wheeless & Allen, 2007) and outcomes (Hackman & Walker, 1990) in distance learning.

Presence is best described as the degree to which a person on the other side of a screen (peer or teacher) is perceived as being real (Gunawardena & Little, 1997). Based on the assumption that teachers and peers are critical to the success of a student’s learning, and that videoconferencing, by its nature, involves the physical separation of learners and teachers, it is critical that videoconference teachers prioritize the development of presence in their courses. The findings of this research
showed that factors that lead to presence (immediacy behaviours, relationships, informal conversation, reliable technology, private space) were most important to both teacher and student participants. In other words, teachers and students considered participant satisfaction as an important outcome of videoconferencing. This priority differs from that of the school division administrations, who consider the achievement of learning outcomes and course requirements as the primary goal of videoconferencing (Anderson, 2008). With student priorities in mind, this study focused on identifying ways to improve presence in a course taught by videoconference. A number of recommendations were synthesized:

- Students expect their videoconference teachers to create a high-presence community of inquiry, rich in interaction, connectedness and feedback. This has been reported in studies of post-secondary contexts (Garrison, Anderson & Archer, 2000), and so is even more pertinent in K-12 settings where younger students are considered to be not as self-determining as adult learners. It not sufficient to simply deliver content across a screen in a didactic way, rather teachers should strive to create communities of inquiry through collaborative learning transactions (teacher-to-student and student-to-student). Unfortunately, videoconferencing lends itself to this method of instruction; and so, teachers need to be creative and innovative in their design and approach in order to avoid simply transmitting knowledge.

- Being able to create an effective community of inquiry with high presence across a screen was less a matter of technological, pedagogical and content expertise (TPACK) and more a matter of experience, confidence and enthusiasm. The experienced, confident and enthusiastic teachers had invested time to trial strategies and teaching methods that built stronger instructional relationships and feelings of connectedness. Koehler and Mishra (2009) proposed that a perfect balance of technological pedagogical and
content knowledge will predict teaching success in a technology mediated environment; however, this study showed that strong pedagogical skills alone had more impact. While a minimum level of comfort with the technology is required, communication skills and an awareness of how communication is perceived across a screen were more predictive of high presence.

- Teachers were able to develop presence in their videoconference courses by creating opportunities to meet students in person at least once, paying attention to students individually across the screen and using their names, creating individual privacy-zones for communication, and sharing personal stories. These are all considered immediacy behaviours, first put forth by Mehrabian (1981) and further investigated by communication researchers (Baker, 2010; Bozkaya & Erdem Aydin, 2007) in the context of online learning. It appears that immediacy behaviours are important in all teaching exchanges – face-to-face, online and live videoconference.

- When teaching face-to-face and remote students simultaneously, teachers could overcompensate for those who are not physically present by greeting them first, making more eye contact with the camera than with the students close in the classroom, and allocating time for remote students to ask questions and receive feedback and tutoring. This may reduce the possibility of remote students feeling like ‘audience’ members in the back of ‘someone else’s class’, as was reported by a few of the participants in this study and as also reported in the literature (Knipe & Lee, 2002).

*Leverage the technology*

While videoconference technology allows for real-time, two-way communication using audio and visual cues, it is not sufficient to create a rich learning community. The teachers in this study who demonstrated effective practice and reported satisfaction in their role were observed using other communicative and collaborative technologies,
both synchronously and asynchronously, in their courses. This included text messaging, *Google Drive* applications, and *Moodle* where there were times of ‘coming together’ and times of working independently. This aligns with research on adult learners in online courses in which mobile technologies and social media have been found to reduce transactional distance and build stronger communities of inquiry by connecting teachers with students and students with students (Abas, 2015; Lim, Abas & Fadzil, 2011, Alberta Education 2006, Garrison, 2016). It is important to remember, however, that these technologies are not inherently interactive; instead, it is the pedagogy that determines their effectiveness (Kaceski & Koceska, 2013; Maor, 2008, Vaughan, 2008). In fact, many have suggested that a pedagogical paradigm shift is required in order to maximize the affordances of these supportive technologies, moving away from a didactic, lecture-based delivery to a more active, collaborative constructivist approach (Mason, 1998; Palloff & Pratt, 1999). The teachers in this study who were leveraging the synchronous and asynchronous tools available for collaborative constructivist approaches rather than simply lecturing were more effective in creating meaningful and satisfying learning experiences for students. They felt that synchronous videoconferencing technology, alone, was insufficient. Instead, they sought to create a more blended learning which Vaughan and Garrison (2016) claim reflects the direction toward which the distance delivery of courses and subsequent research is moving.

*Champion the videoconference program*

The challenges that most impacted the participant teachers’ ability to deliver effective distance education courses by videoconference were insufficient time, feelings of isolation, poor logistics and scheduling, unreliable technology and limited personal connection with their students. Some of the teachers were finding ways to mitigate these challenges, and those that were most successful at doing so were strongly supported by their administration, and/or were champions of the technology
themselves. Videoconference programs that were championed by the administration, the teachers, and the wider school community led to prioritized scheduling, opportunities to bring people face-to-face, effective technology, on-site facilitators, and time allocated for professional development and planning. This, in turn, created better learning environments for teachers and students, and consequently, more support. As shown in this research, videoconferencing should be considered more than just a cost-effective modality for delivering courses for remote students. In addition to the technology itself, resources and attention need to be given to defining the role of videoconference teacher, developing standards that drive teacher preparation and professional development, supporting on-site assistants (Borup & Drysdale, 2014), listening to teachers as they grapple with the challenges and affordances of the technology, allocating non-teaching time for professional development, and aligning school schedules.

Conduct more research

While the use of videoconferencing in delivering high school courses is still at a relatively early stage, the technology has advanced sufficiently to make it a viable option for distance education providers. This will continue to expand in the future and so research needs to explore effective pedagogies. Researchers of videoconferencing consistently call for further studies (Anderson, 2008; Lawson et al., 2010). Potential avenues for future research include:

- Teaching-as-acting in a videoconference and its connection to developing presence – performers who act need to develop stage and/or screen presence to engage audiences. The teachers in this study engaged student attention to varying degrees in the videoconference which could be influenced by their ability to develop this type of presence. Following up on work done on acting training in teacher preparation programs (Griggs, 2001; Javidi, Downs & Nassbaum, 1998; Sarason, 1999), further research could investigate whether
This kind of training would develop better teacher presence and therefore improve students’ attention and engagement.

- Some researchers have suggested that by developing a ‘sense of place’ in an internet-enabled learning community, teachers can cultivate presence and improve the quality of student learning (Brook & Oliver, 2003; Northcote, 2008). There is common ground between this study of videoconferencing and the investigation of issues of embodiment in virtual spaces (Land, 2004) and social presence, or the degree to which a person on the other side of a screen is perceived as being real (Gunawardena & Little, 1997). The development of a sense of place and embodiment warrant research within the videoconference context, particularly in regards to building presence.

- Many teacher education programs employ alternative modalities of delivery for course work such as videoconferencing, online and blended learning approaches. However, rarely are teachers explicitly taught the skills required to employ these technologies in the delivery of their own courses once they become practitioners. The participants in this study all reported that they taught themselves to teach by videoconference through trial and error with little or no pedagogical resources and research to guide them. Future research should investigate how teacher training programs can better prepare teachers for the varying ways in which courses are delivered with technology, and also research ways to support those teachers who are already experimenting in the field by formalizing this work into action research or practical inquiry (Kemmis & McTaggart, 1990; McCutcheon & Jung, 1990).

While care needs to be taken with generalizing the findings from a qualitative study, this research could have implications for any setting where instruction happens across a screen. This includes fully online and blended courses where live synchronous tools are integrated with asynchronous tools, such as discussion boards, or flat resources,
such a print modules. The findings about immediacy behaviours and presence also have implications for workplace meetings that are conducted via videoconference. In fact, whenever you are communicating across a screen it is important to address participants by their names, look directly into the camera, and pay attention to the performance aspect of the exchange.
LIST OF REFERENCES


Murphy, E. & Coffin, G. (2003). Synchronous communication is a web-based senior high school course: Maximizing affordance and minimizing constraints of the tools. *The American Journal of Distance Education*, 17(4), 235-246


APPENDICES

Appendix 1 - Instruments

TPACK instrument


5-item Likert-type scale (1=Poor, 5=Excellent)

Pedagogical Knowledge
1. My ability to determine a particular strategy best suited to teach a specific concept.
2. My ability to use a variety of teaching strategies to relate various concepts to students.
3. My ability to adjust teaching methodology based on student performance/feedback.

Technological Knowledge
4. My ability to troubleshoot technical problems associated with hardware (e.g., network connections).
5. My ability to address various computer issues related to software (e.g., downloading appropriate plug-ins, installing programs).
6. My ability to assist students with troubleshooting technical problems with their personal computers.

Content Knowledge
7. My ability to create materials that map to specific district/state standards.
8. My ability to decide on the scope of concepts taught within in my class.
9. My ability to plan the sequence of concepts taught within my class.

Technological Content Knowledge
10. My ability to use technological representations (i.e. multimedia, visual demonstrations, etc.) to demonstrate specific concepts in my content area.
11. My ability to implement district curriculum in an online environment.
12. My ability to use various courseware programs to deliver instruction (e.g., Blackboard)

Pedagogical Content Knowledge
13. My ability to distinguish between correct and incorrect problem solving attempts by students.
14. My ability to anticipate likely student misconceptions within a particular topic.
15. My ability to comfortably produce lesson plans with an appreciation for the topic.
16. My ability to assist students in noticing connections between various concepts in a curriculum.

Technological Pedagogical Knowledge
17. My ability to create an online environment which allows students to build new knowledge and skills.
18. My ability to implement different methods of teaching online.
19. My ability to moderate online interactivity among students.
20. My ability to encourage online interactivity among students.

**Technological Pedagogical Content Knowledge**

21. My ability to use online student assessment to modify instruction.
22. My ability to use technology to predict students' skill/understanding of a particular topic.
23. My ability to use technology to create effective representations of content that depart from textbook knowledge.
24. My ability to meet the overall demands of online teaching.
Confidence and Experience Teacher Questionnaire

Background
1. How many online courses have you taught in your career?
2. What online courses are you teaching this semester?
3. Circle all the methods you will use to connect with your students
   a. Synchronous video-conferencing
   b. Synchronous audio-conferencing
   c. Telephone
   d. Email
   e. Learning management system
   f. Discussion board
   g. Face-to-face meetings
   h. Bridged interactive whiteboard
   i. Lecture capture
   j. Other

Confidence
5-item Likert-type scale (1=Strongly Disagree, 5=Strongly Agree)

4. I am confident about getting to know my students online.
5. I am confident about delivering instruction across a screen.
6. I am confident about administering this course online.
7. I am confident about designing activities for online learning.
8. I am confident about motivating students online.
9. I am confident about managing student behaviour online.
10. I know how to adapt the pedagogy I use in face-to-face classes for teaching online.
11. I am comfortable with using technology in education.
12. I am confident about getting students to work together in an online course.
13. I know where to access resources to help me teach online.
14. I am excited about teaching online.
Teaching Presence Scale


5-item Likert-type scale (1=Strongly Disagree, 5=Strongly Agree)

A.1. Instructional design and organisation

1. My teacher clearly communicated important course goals (for example, provided documentation on course learning objectives).

2. My teacher clearly communicated important course topics (for example, provided a clear and accurate course overview).

3. My teacher provided clear instructions on how to participate in course learning activities (e.g. provided clear instructions on how to complete course assignments successfully).

4. My teacher clearly communicated important due dates/time frames for learning activities that helped me keep pace with this course (for example, provided a clear and accurate course schedule, due dates, etc.).

5. My teacher helped me take advantage of the online and videoconference environment to assist my learning (for example, provided clear instructions on how to participate in online discussion forums).

6. My teacher helped students to understand and practice the kinds of behaviors acceptable in online and videoconference learning environments (for example, provided documentation on “netiquette” i.e. polite forms of online interaction).

A.2. Facilitating discourse

7. My teacher was helpful in guiding the class towards understanding course topics in a way that assisted me to learn.

8. My teacher acknowledged student participation in the course (for example replied in a positive, encouraging manner to student submissions).

9. My teacher helped to keep students engaged and participating in productive discussions.

10. My teacher helped keep the students on task in a way that assisted me to learn.

A.3. Direct instruction

11. My teacher presented content or questions that helped me to learn.

12. My teacher helped to focus discussion on relevant issues in a way that assisted me to learn.
13. My teacher provided explanatory feedback that assisted me to learn (for example, responded helpfully to discussion comments or course assignments).

14. My teacher helped me to revise my thinking (for example, correct misunderstandings) in a way that helped me to learn.

15. My teacher provided useful information from a variety of sources that assisted me to learn (for example, references to articles, textbooks, personal experiences or links to relevant external websites).
Appendix B – Ethics Approval

Tuesday, 23 April 2013

Dr Dorit Maor
School of Education
Murdoch University

Dear Dorit,

Project No. 2013/067
Project Title Teachers’ Pedagogical Presence in Online Secondary Classrooms that Use Web-conferencing

Your application in support of the above project was reviewed by the Education Expedited Sub-Committee of the Murdoch University Human Research Ethics Committee.

Decision of Education Sub-Committee:

APPROVED

Approval is granted on the understanding that research will be conducted according to the standards of the National Statement on Ethical Conduct in Human Research (2007), the Australian Code for the Responsible Conduct of Research (2007) and Murdoch University policies at all times. You must also abide by the Human Research Ethics Committee’s standard conditions of approval (see attached). All reporting forms are available on the Research Ethics web-site.

I wish you every success for your research.

Please quote your ethics project number in all correspondence.

Kind Regards,

Dr. Erich von Dietze
Manager of Research Ethics

cc: Dr Andrew McConney
Nicole Retu
School of Education – Dr Lindy Norms

REC Approval letter 140113