How teachers’ experience, attitudes, and self-efficacy concerning technology influence its use in the classroom

by

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B. Phys. Ed., University of Alberta, 2005
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Supervisory Committee

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Abstract

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Technology is a driving force behind change across multiple aspects of society and education is no exception. How teachers plan, instruct, and assess in the classroom are all undergoing drastic and significant changes due to technology. With these changes comes the need to be cognizant of how who we are as educators affects how we use technology. The research literature suggests that experience with, attitudes towards, and confidence in using technology influences how teachers use technology in the classroom. While there continues to be debate within the research community around technology’s effectiveness to aid learning when left in the hands of students, this review looks to explore some aspects of how the teacher’s role helps create the best possible environment for learning with technology. The focus of this paper addresses how teachers experience with, attitude towards, and self-efficacy around technology influence its use in the classroom. The purpose of this review is to understand our impact as educators on the use of technology in the classroom and offer a basis for reflection on how the choices we make influence the learning environment, the technology we use, and skills students develop.

*Keywords:* technology and learning, technology education, educational technology, teacher’s role/impact
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Chapter 1: Introduction

This review examines some aspects of teachers’ impact on technology use within the classroom. Technology has permeated education in the same way that it has society. No longer is technology seen as new and upcoming, but instead as a necessary part of everyday life. Students in our schools not only need content knowledge and process skills but the ability to use technological tools for educational goals such as those that impact learning (Willis, Weiser & Smith, 2016). Digital literacy has been identified as important for our student’s futures (Forzani & Leu, 2012) and as educators, teachers must explore its impact on student learning in the classroom.

The research suggests that educators have an impact on how technology is used within the classroom. A number of factors such as years of teaching experience, prior experience using technology, professional development opportunities, and how teachers already integrate technology into teaching impact how technology is used within the classroom (Ritzhaupt, Dawson, & Cavanaugh, 2012). Teachers’ lack of basic skills, negative attitudes, and need for professional development are paramount in the conversations addressing technology integration (Coklar, & Yurdakul, 2017). In the following sections, I begin by exploring my personal interest in this topic and then explore how teacher experience, attitudes, and self-efficacy around technology influence the way technology is used by students and its effectiveness.

Personal Interest

My own interest in technology has led me to engage with the topic throughout my teaching career in a way that brings meaning and understanding to my students. Technology in schools has typically unfolded as a new program to learn rather than
providing digital fluency regardless of specific devices or application. However, technology is no longer about what device or program you choose to use but a more general level of comfort with all technology and how best to leverage it for the desired purpose. Understanding the teachers’ role with and impact on technology is important in providing the best possible education for students.

I have always been interested in technology, its use, and application within education. As an aspiring teacher, I took my interest in technology and applied to my education degree, receiving a minor in Instructional Technology. As my career progressed, I noticed certain problematic trends with the way technology was viewed, implemented, taught, and used within the educational setting. Technology was perceived by the school faculty as the responsibility of complimentary course or technical teachers and not something to be fully embraced within every classroom. Technology skills taught in core classes were specific to that course and often mundane tasks or time saving measures. More alarming was the way in which we looked to technology to replace the teacher and their professional judgment, rather than as a tool to be used to aid learning. This was the impetus for my interest in understanding how our own experience, attitudes, and confidence with technology impact the learning environment and the decisions around technology integration and how we leverage technology or limit its use and effectiveness.

The society in which we live has not helped this situation as it keeps bombarding the education system with digital devices, digital content, and as a result provides an unparalleled level of access to information compared to any prior time in history. We have long passed the time of asking ourselves if technology has a place in education, but
rather, should be asking questions about which technologies should be used, what are the
most effective uses for these technologies, and what is the saturation level of technology
within learning. With the speed at which technology is changing these questions have
become harder to answer with certainty or with a sense of longevity. Education is not an
institution known to handle change effectively and yet, with the rest of society, has been
thrust into the technological era where change is one of the only constants.

The impact of technology on learning has long been debated with champions on
both sides of the argument, but more often than not teachers are stuck in the middle to
weather the storm of change, not feeling supported or confident in their own skills.
Looking at technology as a tool for learning leads us back to the impact of the people
using the tool. I wish to expand the discussion beyond technology ability to aid learning,
and look at the how teachers’ experience with technology impact its use, attitudes toward
technology influence decisions, and how self-efficacy around technology guide use. We
have always said that the teacher is the largest affecting factor to learning within a
classroom and as such they need to be a large part of our discussion around technology
implementation and its impact on learning.

Background

In today’s world technology changes rapidly and teachers’ experiences with,
attitudes towards, and self-efficacy in using technology can have a huge impact on the
way that it is used within the classroom. With the speed of change in the world of
technology, integration within the classroom will always be a moving target and
something that can never be seen as fully accomplished (Ritzhaupt et al., 2012). This
reality has shifted the focus away from technological skill acquisition towards effective
technology integration into the learning environment (Willis et al, 2016). Throughout the last few decades, technology within the classroom has moved from chalkboards and overhead projectors to handheld computers, tablets, virtual reality, and interactive projectors. Even as the educational system has navigated these classroom changes, it is acknowledged by Knowles (1970) that the teacher continues to have the greatest impact on what happens in the classroom (as cited in Cannon, Kitchel, Duncan, & Arnett, 2011). Thus, it is important to focus on the teacher as they play an important role in the way technology based learning is structured (Levin, & Wadmany, 2008) Without teacher involvement, technology integration will not occur (Coklar & Yurdakul, 2017) and the literature reveals that a teacher’s experience, attitudes, and self-efficacy around technology are key areas to explore.

**Experience.** A teacher’s experiences affect how teachers use technology within the classroom (Sahin, Top, & Delen, 2016). Insufficient prior experience with technology use, the number of technology devices a teacher has, inconsistent school level policies, or poor implementation all affect technology integration (Sahin et al., 2016). Parker (as cited in Baek, Jung & Kim, 2008) suggests other experiences that affect our use or avoidance of technology can include factors such as lack of time or the skills needed to implement technology. Creating diverse experiences with technology for teachers has been shown to develop abilities and aid in the integration of technology (Russell, Bebell, O’Dwyer, & O’Connor, 2003). If teachers hope to expand the way in which technology is used within the classroom they need to expand their own experiences with technology.

There is also a need to evaluate our teacher training programs and the way in which they expose teachers to technology. Pre-service teachers need to be trained with
“contemporary technology-enabled learning design capabilities” to aid in developing students in today’s classroom (Bower, Highfield, Furney, & Mowbray, 2013, p. 39). These ideas speak to how our experiences mold who we are as educators, the effect these have on technology use, and the ways in which we choose to implement and teach technology.

**Attitude.** There is evidence to suggest that teachers’ attitudes towards technology affect its use in the classroom. The more positively teachers view technology, the more inclined they are to use it in the classroom (Domingo & Gargante, 2016). However, when teachers only use technology due to government mandates, curriculum, or convenience they lose sight of using technology to raise the quality of learning and focus more on demonstrative purposes (Baek et al, 2008). This difference in attitude explains the discrepancy found in teachers’ views of what is important within technology curriculum (Norstrom, 2014) and whether we conceptualize technology teaching from a content driven or student driven paradigm (Khan, Bibi, & Hasan, 2016). It is important to understand our own beliefs and attitudes around technology and how they influence the way in which we integrate and teach technology. Our view of technology’s importance impacts the way in which we integrate it into the learning environment.

**Self-efficacy.** In this review of literature around how teachers can use technology in the classroom effectively, teacher’s belief in their own ability to use technology to aid learning, also known as self-efficacy, has an impact on technology’s use and effectiveness emerged as a prominent theme (Albion, 2001; Yerdelen-Damar, Box, & Aydin-Gunbatar, 2017). Teacher self-efficacy with technology is important to develop as it is linked to a teacher’s ability to use technology effectively in the classroom (Albion,
Having teachers who are confident in their abilities is important for implementing technology based learning (Lemon & Garvis, 2015). Teacher self-efficacy has been shown to be one of the most powerful influences on student achievement (Tschannen-Moran, Hoy, & Hoy, 1998). Increasing teachers’ self-efficacy calls for appropriate professional development (Hartell, Gumaelius, & Svardh, 2015) and can be enhanced with sustained collaborative professional development (DeSantis, 2013). The effect of professional development on self-efficacy is worth exploring as part of the discussion.

All of these focus areas bring to light the importance of the teacher when discussing the impact technology can have on learning content or in providing us the digital skill to function well in a digital society and work force. As a result, the following research questions have been identified to guide this review.

**Research Questions**

1. How does teacher background and ongoing experience with technology relate to their use of technology in their classroom?

2. How does teacher attitude impact their approach to technology use in the classroom?

3. How does teacher self-efficacy around technology influence its use in their classroom?

**Definitions**

**Digital literacy.** Using digital tools and having the ‘ability to adapt the affordances and constraint of these tools to particular circumstances’ (Jones & Hafner as cited by Pangrazio, 2016, p. 163).
**Educational technology.** The study and ethical practice of facilitating learning and improving performance by creating, using, and managing appropriate technological processes and resources (Richey, Silber, & Ely, 2008).

**Self-efficacy.** The belief in one’s own ability to organize and execute the actions needed to accomplish specific tasks in specific contexts (Tschannen-Moran et al, 1998).

**Technology.** Electronic tools, systems, devices and resources that generate, store or process data. These includes social media, online games and applications, multimedia, productivity applications, cloud computing, interoperable systems and mobile devices. (Digital Technology, n. d.)

**Research Pathway**

To begin looking for research I started by looking at two topic searches. The first being teachers impact on technology integration, and the second being technology’s impact on learning. Such terms used for the search included “teachers and technology”, “teachers effect on technology”, “technology and learning, and “technology’s effect on learning.” The findings in each area were overwhelming and I discovered that doing both topics was going to be too wide of scope for this paper. Reading of the research of the initial searches guided the narrowing of my focus to how teacher’s experiences, attitudes, and self-efficacy affected the use and integration of technology in the classroom setting.

A second search was completed that included search the search topics “teacher experiences and technology”, teacher experiences effect on technology”, “teachers and technology”, “teachers effect on technology use”, “teacher attitudes and technology”, “teacher attitudes effect on technology”, “teacher self-efficacy and technology”, and
“teacher self-efficacy effect on technology.” This provided more focused research articles and showed support for the narrowed themes of the paper. After prevalent research papers were selected for their contributions to the paper’s themes, a search and reading was conducted of prominent support documents from the selected articles bibliographies were conducted. These searches looked at the documents that were used to support findings on the selected themes and articles or authors that repeatedly showed up within multiple research papers.

The searches were conducted using the University of Victoria Library search engine that pulled from peer reviewed journal articles and textbook resources. Google scholar was also used to supplement the searches done on bibliographies when the University of Victoria’s search engine could not fine the desired research article.

At the end of the search process, empirical research articles including quantitative and qualitative data were found that discussed the impact a teacher’s experiences, attitudes, and self-efficacy has on K-12 classrooms along with studies that looked at post secondary teacher training programs and their effect on technology’s use and integration in classrooms. Among the guiding documents were theoretical peer reviewed articles that provide an understanding and framework for the empirical findings.

The next section discusses the findings of the articles showing that teacher’s experiences, attitudes, and self-efficacy affect whether and how technology is used in the classroom setting. The evidence suggests that all of these factors can have an impact on the way in which technology is used within the classroom and provides an understanding of how teacher’s experiences, attitudes, and self-efficacy need to be monitored and managed to promote the most productive use of technology for learning.
Chapter 2: Literature Review

The purpose of this section is to review a portion of the literature to see what it indicates are the factors that affect teachers’ use of technology within the classroom. The review highlights that there are factors that affect teachers’ willingness to use technology in the classroom and the decisions they make around technology’s use. Three factors emerged as affecting teachers’ technology use; teachers’ experiences, teachers’ attitudes towards technology, and teachers’ self-efficacy related to technology. Using these themes three questions were explored: how do teacher background and ongoing experiences with technology relate to technology use in their classroom; how does teacher attitude impact their approach to technology use in the classroom; and how does teacher self-efficacy around technology influence technology’s use in the classroom?

While reviewing teachers’ experiences, much of the literature spoke about prior experiences, logistical factors, teachers’ years of experience, and the experiences that pre-service teacher programs offer upcoming professionals thus they have been added as subthemes that could, positively or negatively, impact teachers’ use of technology within the classroom. Within this theme, Norstrom (2014), Hartell, et al. (2015) and Blackwell, Lauricella, & Wartella (2014) speak to how our experiences shape how we view technology and show that different experiences lead to different views of the importance of technology or a different view about which parts of technology learning are important. Sahin et al. (2016), Baek et al. (2008), Hur, Shannon, and Wolf (2016) address how our experiences with external factors such as administration, infrastructure, and policy influence teachers choices and bring to light strategies to create a positive influence on classroom technology use. Based on work by Ritzhaupt et al. (2012) and Sahin et al.
(2016) we understand that years of experience do not correlate with technology being used within the classroom. Additionally, Anderson and Groulx (2015), and Sadaf, Newby, and Ertmer (2012) explain how the experiences students have in pre-service training programs guide the decisions they will make around technology once they are teaching in a classroom.

In the second theme regarding teachers’ attitudes about technology, the work of Kurt (2012), Ertmer (1999), and Leman and Garvis (2015) address how teachers form attitudes and beliefs based on their experiences and these attitudes shape choices around technology and can often be hard to change once attitudes have formed. Through the research, I address how attitudes affect technology use based on work by Hur et al. (2016), Domingo and Gargante (2016), and MacArthur and Malouf (1991). Teo et al. (2008), Ertmer (2005), Laher (2015), and Kim et al. (2013) guide the discussion on the creating and changing of attitudes. Lastly the rigid nature of teachers’ attitudes towards technology is presented based on the work of Ertmer (1999), Pajares (1992), and Lemon and Garvis (2015).

The third section of this review touches on the work of Hartell et al. (2015), Ritzhaupt et al. (2012), Tschannen-Moran et al. 1998) showing that teacher use of technology is tied to teachers’ self-efficacy around technology and that professional development has a direct impact on teachers’ sense of capability when using technology. This discussion addresses the general impacts of self-efficacy on technology use by looking at research by Lemon and Garvis (2016), Albion, (2001), and Tschannen-Moran, Hoy, and Hoy (1998). Hartell et al. (2014), Hill et al. (1987), and Tsitouridou and Vryas’s (2004) work sheds light on how training received by teachers affects self-
efficacy. Finally, professional development impact on self-efficacy is discussed by DeSantis (2013), Yerdelen-Damar et al. (2017), and Ritzhaupt et al. (2012).

**Teachers’ Background and Ongoing Experiences With Technology**

**Introduction.** The first question the review looks to answer is how does teacher background and ongoing experiences with technology relate to their use of technology in their classroom? The review aims to see if the experiences teachers have can positively impact their technology use. The literature provides evidence that the experience of teachers can influence technology use for the positive but can also hinder technology’s integration when care is not taken to guide a teachers’ experiences toward positive outcomes (Baek et al., 2008; Blackwell et al., 2014; Coklar & Yurdakul 2017; Hu et al., 2016; Pelgrum, 2001; Sahin et al, 2016). Caution is expressed in the literature as, while evidence shows the importance of a teacher’s impact on technology use within the classroom, many studies focus, not on the factors that influence a teachers’ decisions around technology in their class, but instead on how to integrate technology into the curriculum or on improving a teachers’ technological professionalism (Baek et al., 2008). The review indicated four ways that teachers' experiences relate to a teachers’ use of technology within the classroom: prior experience, experience of logistical and administrative factors, years of experience, and pre-service teachers and programs.

**Prior experience.** The empirical findings show that a teacher’s prior experiences shape how they view and teach technology (Hartell et al., 2015; Norstrom 2014). The research showed that differing experiences with technology and teaching affect technology’s integration as they can lead to a lack of consistency in what is seen as important to teach with regard to technology and how we evaluate its use (Norstrom,
Norstrom found teachers’ differing level of experience with technology affect the prioritization of technology and what content is seen as valuable which leads to differing levels of technology use within the classroom. The discrepancy in technology integration and teaching, that our differing experiences create, is seen even when guiding curricular documents are provided because of the lack of training or experience teachers have with technology (Hartell et al., 2015). Hartell et al. (2015) further explain that this lack of experience and training leads to little integration or teaching of technology within the classroom and that experiences with technology, or lack there of, have a negative impact on technology use within the classroom. This evidence showing that a lack of prior positive experience with technology decreases future use and creates inconsistency in how it is used or taught is confirmed by the Ritzhaupt et al. (2012) study showing that experience in teaching with technology increases teacher and classroom use of technology.

**Experience of logistical and administrative factors.** The research provides evidence to support the notion that the way in which logistical and administrative factors are experienced can become an obstacle for technology’s use (Baek et al, 2008; Blackwell et al, 2014; Hur et al., 2016; Pelgrum, 2001). Pelgrum (2001) found that among the most prominent obstacles for teachers to integrate technology are insufficient access to technology, lack of technical assistance, infrastructure issues, and a lack of time which leads to negative experiences causing a decrease in technology’s use in the classroom. This is similar to Blackwell et al. (2014) findings that show perceived support from the school and appropriate technology policy, or lack there of, influence teacher technology use. Other research provides similar evidence of the importance of such
factors but provide insight into how these factors can also produce positive experience and an increase in technology’s use (Hur et al., 2016). This study indicates that having an appropriate budget is seen as critical to increase the possibility that teachers have positive experiences with technology due to adequate access to technology, technical support, and working hardware and software.

While it is important to have teachers see the value in technology use within the classroom evidence shows that most teachers are motivated to use technology when there is a sense of convenience (Baek et al., 2008) or perceived ease of use (Anderson & Groulx, 2015). The evidence provided in this section suggests that if teacher’s experiences with technology allow for enough accessibility, are not time consuming, and are problem free, teachers are more likely to use technology. However, if their experience using technology is riddled with technical issues, lack of connectivity, and difficult policy then teachers will shy away from its use (Anderson & Groulx, 2015; Baek et al., 2008; Blackwell et al., 2014; Pelgrum, 2001).

**Years of experience.** The evidence indicates that the further a teacher is in their career the less likely they are going to engage with technology or integrate it into their classrooms (Baek et al, 2008; Ritzhaupt et al, 2012; Sahin et al, 2016). Ritzhaupt et al. (2012) found that a teacher’s years of experience have the highest negative effect on a teacher’s use of technology within the classroom, but they do not attribute any reason for the negative effect. Sahin et al. (2016) confirms this finding indicating that a teacher’s level of experience does not correlate with a comfort of using technology within the classroom, again indicating a lack of desire to integrate technology the longer teachers are in the classroom. They propose this is due to the difficulty of learning new
technological tools within the classroom and the resistance to change that this causes, which in return decreasing a teacher’s technology use within the classroom,

Other evidence indicates that as years of experience increase, the motivation to use technology within the classroom can change, being motivated largely due to external requests, and the expectations of others (Baek et al., 2008), thus classroom technology use is negatively affected unless there is outside pressure to engage with its use. In their study, these authors found the increase in external forces motivating change is paralleled with a decrease in the use of technology’s more advanced abilities, and an increase in technology’s use only when it use is seen to relieve teacher physical fatigue or reduce preparation time and effort. Other evidence supports this idea suggesting that subjective norms and ease of use are among the strongest predictors to technology use (Anderson & Groulx, 2015). The empirical evidence shows a strong connection between years of experience and decreases in teachers’ technology integration and use within the classroom.

While years of experience correlate to a general trend towards decreased technology use, it is not an infallible predictor. There is research that also suggests years of experience can have a positive impact on a teachers’ decision to use technology within the classroom. The study conducted by Blackwell et al. (2014), contrary to their hypothesis, showed some evidence that technology use may increase with experience as more practiced teacher’s greater educational experience could encourage the incorporation of technology. Confirming this finding, Sahin et al. (2016) indicate in their research that technology is integrated more effectively when sufficient technological, pedagogical, and content knowledge are present. This type of situation occurs more often
later in teachers’ careers rather than at the onset. Russell et al. (2013) also produce findings indicating that even though newer teachers have had exposure to more technology than those that came before them, and this exposure creates a comfort with using technology, it does not always translate into an increased use of technology within the classroom. The empirical findings support the general understanding that in general years of experience create a situation where teachers decide to use less technology within the classroom, but also indicate that this does not need to be the case and steps can be taken to increase the likelihood of technology’s use by those later in their career.

**Pre-service teachers and programs.** Because pre-service education teachers receive instruction on how to use technology in the classroom, it is important to be aware of how these pre-service experiences encourage the use of technology. The data shows that the experiences pre-service teachers have impact their view of technology and the decisions they make in regard to its use in their classroom once they enter the teaching profession (Anderson & Groulx, 2015; Hsu, 2013; Sadaf et al, 2012).

Some see the lack of technological integration within the classroom to be the shortfall of teacher education programs (Tsitouridou & Vryzas, 2004). Bower et al. (2013) recognize the new twenty-first century skills needed within the classroom, and with these skills becoming part of teacher accreditation standards, meeting these new standards will rely on our pre-service teacher institutions developing programs that provide “contemporary technology-enabled learning design capabilities” (p. 39). This requires changing pre-service programs so that they equip upcoming teachers with the skills needed to engage technology within the classroom. The data shows the connection between technology skills being taught within our pre-service teacher education programs
and the link to increased use of technology once those teachers are in the field.

Research also tells us that pre-service practicum experiences can have a positive or negative effect on pre-service teachers decisions to use technology within the classroom (Anderson & Groulx, 2015; Hsu, 2013; Sadaf et al., 2012) Sadaf et al. (2012) found those people who pre-service teachers deem important, such as colleagues, administrators, or mentor teachers, influenced their own beliefs around technology integration. Based on the findings of Anderson and Groulx (2015) there is an expressed need to select carefully those that work with pre-service teachers making sure they collaborate with pre-service teachers and model effective technology integration. This modeling can help change pre-service teachers opinions of technology within the classroom and the effect technology will have on student learning (Hsu, 2013) increasing the likelihood of technology being among pre-service teacher’s repertoire of skills to be used, once in the field. Hsu’s study does caution that pre-service teachers’ beliefs around technology do not automatically change due to the modeling of an effective cooperating teacher, but shows that pre-service teachers experiences need to include reflective activities that “confront and challenge preservice teachers’ beliefs, gain access to cooperating teachers’ decision making processes, and examine preservice teachers’ changes in beliefs” (2015, p. 45) in order to be effective at increasing technology integration.

**Discussion.** The literature addressed here shows that the experiences teachers have do impact their choices around technology use within the classroom. The literature presents the idea that how teacher experiences are perceived or the quality of their experiences dictate the use of technology within the classroom more than the specific
type of experience. It is the way in which obstacles are dealt with or mitigated that has a larger impact on the choices teachers make around technology integration. With the hope of implementing technology within the school, it is in how leaders guide the experiences of teachers to be positive rather than allowing a lack of planning, insufficient technology, poor infrastructure, and misalignment of policy to cause negative experiences. One area where school leaders can positively influence technology integration is through the influence they have over school budgets, making sure money is allocated in a way that access to technology, technical support, and a robust infrastructure are in place (Hur et al., 2016), thus limiting such obstacles. Sahin et al. (2016) see it as administrations role and responsibility to provide the technological devices, training, and support for teachers at not cost in order that technology gets integrated into instruction appropriately and at adequate levels.

Even though years of experience creates a disconnect with using technology, as noted above, there is a need for a pairing of sufficient understanding of technology, pedagogy, and content for the benefits of technology to be recognized (Sahin et al., 2016). While upcoming teachers may have comfort with technology, it needs to be partnered with the strong pedagogy and content knowledge that only comes with years of teaching experience. It is through training that later career teachers gain the skills lacking due to their limited experience with technology and move toward increased technology use within the classroom.

As stated above, much research shows the link between the experiences teachers have in their pre-service teaching programs. These programs need to provide relevant learning aimed at preparing students not just with content knowledge but the ability to
teach within an environment that embraces the integration of technology. With so many teachers being motivated to use technology out of convenience, relief of physical fatigue, or a desire to decrease time and effort, teacher education programs are tasked with “challeng(ing) teachers to remain cognizant that technology is used for enhancing instruction and learning and not only for demonstrative purposes” (Baek et al., 2008, p. 233).

**Conclusion.** Educational leaders should strive to remove these barriers that create negative experiences with technology and plan for other internal and external factors that create positive experiences for teachers that mold their technology use. The literature offers the understanding that being cognizant of teacher’s experiences is important as these experiences guide the creation of the beliefs and attitudes teachers develop around technology. How a teacher’s attitudes influence technology use will be explored in the next section.

**Teachers’ Attitudes Impact on Their Approach to Technology Use**

**Introduction.** The second question addresses how teacher attitudes impact their approach to technology use in the classroom? The goal is to learn if teacher’s attitudes affect their use of technology and how those attitudes can be created or changed to positively influence technology integration. There is research that connects teachers’ positive attitudes towards technology with increased use of technology within the classroom (Domingo & Gargante, 2016; Hur, et al., 2016; Kim, Kim, Lee, Spector, and DeMeester, 2013; Levin & Wadmany, 2008). The empirical evidence also suggests that not only do our experiences impact our decisions to use technology within the classroom, they have a compounded effect as they help create and shape the attitudes that teachers
develop around technology (Hart & Laher, 2015; Hsu, 2013; Kim et al., 2013; Levin & Wadmany, 2008). Teachers’ attitudes and beliefs around the role of technology within education are seen as some of the final obstacles to technology being fully integrated into teaching and classroom activities (Kurt, 2012). While it is shown that a teacher’s attitudes strongly influence their decisions around technology, care is needed as attitudes are developed around technology because the research shows attitudes and beliefs around technology are developed early on in a teachers’ career and gain a sense of rigidity once they are formed (Ertmer, 1999, 2005; Han, Shin, & Ko, 2017; Pajares, 1992). Through this review three subthemes became evident: the effect of attitudes on technology use, the creation and changing of attitudes, and the rigidity of attitudes once they are developed.

**Teacher attitudes impact on technology use.** The attitudes and beliefs that teachers hold in regards to technology and teaching impact their approach to technology use within the classroom (Domingo & Gargante, 2016; Hur et al., 2016; MacArthur & Malouf, 1991; Sahin et al., 2016). Hur et al. (2016) attest that teachers’ beliefs and attitudes around technology integration are critical to the decisions they make around technology use. Other findings confirm the idea that teacher technology use is influenced and guided by their attitudes about computers and their educational application (MacArthur & Malouf, 1991). The data suggest that the positive attitudes teachers hold towards technology translate into an increased desire to use technology (Domingo & Gargante, 2016). The opposite effect is also seen in the literature as prior negative experiences, practices, or preconceived prejudices can cause negative attitudes within teachers and decrease their use of technology in the classroom (Sahin, et al., 2016).
Teacher attitudes around technology are not the only influence on technology’s use as studies show that teacher attitudes about other aspects of teaching affect technology integration as well. Kurt (2012) found that many, if not most, teachers see technology as important to the classroom in today’s education system, but those same teachers could have other issues to deal with that are perceived as being more important and thus could get more attention, thereby taking precedent over technology. Kurt’s (2012) research suggests that teacher attitudes towards classroom size, their salary, their busy schedules, marking, and other required duties or district initiatives can have an impact on their approach or desire to use technology thus interfering with technology integration. Empirical evidence from MacArthur and Malouf, (1991) also suggest that a teacher’s attitudes towards educational goals, classroom organization and management, and type of instructional planning can affect how a teacher approaches technology within the classroom as well.

**Creation and changing of attitudes.** Perceptions of technology’s usefulness and cultural relevance were among the strongest predictors of teachers’ attitudes towards technology (Teo et al., 2008). Following this thought, Ertmer (2005) says it is less effective to expect teachers to engage in technology with high-end goals from the onset but to ease in with relatively simple tasks that will begin the change process. Other research shows that cultural and social norms need to be considered in order for lasting changes with technology to take place because without a positive attitude towards its relevancy, technology’s use within the classroom will not be seen as valuable (Hart & Laher, 2015). For example, a cultural environment that promotes ideas such as all teaching should not be teacher-centered, would leave room for technology to be used
within the classroom (Kim et al., 2013). For technology to be integrated into the classroom, research shows that teachers’ attitudes must be accounted for and teacher “beliefs should be considered in order to facilitate technology integration” (Kim, et al., 2013, p. 82). Kim et al.’s (2013) research argues that designing interventions that work to change teachers’ attitudes and beliefs around technology and its use in teaching could be a more effective and efficient way of attaining integration than other interventions focused on practical aspects of technology use in the classroom. Ertmer (1999) argues this point as well saying more important are the “second order” barriers which are intrinsic to teachers and include their “beliefs about computers, established classroom practices, and unwillingness to change” (p. 48) and thus challenging second order barriers requires the hard work of changing teachers attitudes which become resistant to changing after early experiences of teaching. While these barriers to technology integration are seen as second-order barriers, closer to the core of teachers’ attitudes around teaching, learning, and education, first-order barriers need to be addressed as well, making sure that aspects such as access to technology, infrastructure, and school policies are not a hindrance to technology’s integration in the classroom.

Looking more deeply into what impacts the creation of differing attitudes Kim et al. (2013) found evidence that teachers’ experiences need to be leveraged and encouraged in a way that they challenge teachers’ current attitudes with the aim of producing better student learning. Sahin et al. (2016) found that, similar to our experiences, such external factors as poor technical supports and a lack of rules or guiding policies around technology’s use within a classroom setting can create poor attitudes towards technology within teachers, which ends with teachers and students feeling disappointed with
attempted technology integration. Ertmer (1999) would consider most of these to be “first order” barriers, as described above, that are extrinsic to the teacher with easy solutions like the purchase of more technology or professional development.

**Rigidity of attitudes.** The data shows that attitudes about technology can be rigid and hard to change (Ertmer, 1999, 2005; Pajares, 1992) Evidence informs us that changes in attitudes tend to be seen only when great shifts in thinking occur, but these shifts are rare for adulthood (Pajares, 1992). The literature showed that negative experiences with technology can shape the attitudes teachers have about technology for years to come regardless of interventions aimed to persuade them otherwise (Ertmer, 2005). Ertmer indicates early experiences have the ability to guide perceptions and later experiences around technology and because of the personal nature of our attitudes and beliefs, these attitudes will not likely be changed through persuasive means. These findings make it seem near impossible to create change in attitudes but Kim et al. (2013) found that changing teachers’ attitudes and beliefs can be done, not through a one-time effort, but through sustained incremental changes in practice that are supported and satisfy the needs of the teachers.

Evidence suggests that being attentive to attitudes in order to offer guidance in the creation of positive attitudes, especially early on in a teacher’s career is important (Ertmer, 1999; Han, Shin, & Ko, 2017; Lemon & Garvis, 2015). Ertmer (1999) presented the idea that our attitudes and beliefs around technology are hard to change after early experiences with technology. This finding is important showing the need to be aware of the attitudes our pre-service and young teachers have and how those attitudes can be influenced in a more positive direction through a preventative proactive approach. Lemon
and Garvis’ (2015) research suggest such an approach to guide the creation of teacher attitudes through experiential practice and reflection on their created attitudes. Teo, Luan, and Sing, (2008) found that pre-service teachers’ intention to use technology within the classroom was influenced significantly by their attitudes towards computers. This finding could be leveraged, as data from Han et al.’s (2017) study provides evidence that indicates practicums, mentor teachers, and other pre-service teacher supports can be adjusted to accommodate different teacher approaches and beliefs in order to promote attitudes that encourage technology use within the classroom. The research presents support for engaging pre-service and young teachers in activities the help created positive attitudes towards technology with the hope of increasing a teacher's use of technology.

**Discussion.** It is evident that there is a strong link between teacher attitudes and their desire or willingness to use technology. It has also been shown that teachers’ attitudes can be influenced for the positive or the negative, which can be managed and controlled to some degree by influencing the events and activities that help shape those attitudes. Attitudes play an important part in teachers’ decisions to use technology within the classroom. These attitudes and beliefs are heavily influenced by the early experiences with technology and reinforced throughout their carrier. While these attitudes are core to a teacher they are not completely immovable so care is needed in planning a path forward that moves away from already created negative attitudes creating new more positive attitudes that encourage technology integration. While Ertmer (1999) sees a distinction in how first and second order barriers can influence technology’s use, Levin and Wadmany (2008) found in their longitudinal study that what can matter most is the interplay between the internal and external factors, seen as “multidimensional characteristics and
the synergy between two types of epistemic influences” (p. 256). It is this synergy between the source of the process of technology integration, the nature of the process, and knowledge of technology that create the two developmental continuums at play (Levin & Wadmany, 2008). In other words, it is the way in which external factors intersect with teachers’ internal beliefs about technology and teaching that create and reinforce attitudes about technology within the classroom. Teachers’ attitudes and beliefs are the lens by which they view, filter, and add meaning to their experiences (Levin & Wadmany, 2008), both positively and negatively, and as such it is the interplay and development of meaning that impact teachers’ adoption of technology more than the direct impacts of the technology itself. Therefore a more holistic approach to understanding why teachers do or do not adopt technology within the classroom is needed, that incorporates an understanding of the impact a teachers’ attitudes have on technology’s use.

**Conclusion.** While in this section we see how teachers filter the experiences they have and create attitudes and beliefs about technology from those experiences the next section deals with how teachers see themselves in the process of technology use within the classroom and address the self-efficacy of the teacher.

**Teacher self-efficacy and technology’s use in the classroom**

**Introduction.** The third and final question to be answered by this review is how does teacher self-efficacy around technology influence its use in their classroom? The objective of this questions is to learn how teachers’ beliefs about themselves and their own abilities with technology influence their use of technology within the classroom. The literature expresses support that positive self-efficacy with regard to technology increases
technology’s use within the classroom (Albion, 2001; Ertmer, 2005; Hill et al., 1987; Lemon & Garvis, 2016). Teacher self-efficacy has a predominate role to play within the discussion of technology integration as it plays a powerful influence due to its cyclical nature (Tschannen-Moran et al., 1998). As Tschannen-Moran et al. put it, “greater efficacy leads to greater effort and persistence, which leads to better performance, which in turn leads to greater efficacy” (1998, p. 234). This finding is important because teacher perceived self-efficacy with respect to technology is an important factor that influences teachers’ decisions to use technology or not (Hill et al., 1987) and a teachers’ self-efficacy influences student learning (Hartell et al., 2014). It is through vicarious experiences, which teachers gain through professional development, that allow them to use classroom strategies that incorporate technology and increase their confidence for creating the same behaviors within their classroom (Anderson & Groulx, 2005; DeSantis, 2013; Ertmer, 2005; Ritzhaupt et al., 2012). The literature shows that professional development plays a huge role in a teachers’ self-efficacy. This review looks at three subheadings associated with self-efficacy; general impacts, technology training, and professional development.

**General impact.** Throughout the literature the need is seen for teachers to have the opportunity to gain skills and confidence as they move through a scaffolded approach to technology integration because teachers believe about their own capability of teaching with technology impacts their overall effectiveness (Lemon & Garvis, 2016). Lemon and Garvis (2016) see self-efficacy as a motivational factor as well since teachers’ beliefs about their own abilities motivate the decisions they make and the actions they take within their classroom with regard to technology. Empirical data shows that while self-
efficacy has to do with the perception teachers have of themselves, which could be over or underestimated (Tschannen-Moran et al., 1998), it is important that teachers are confident with technology in order that they engage with experiences that promote technology’s use within the classroom (Lemon & Garvis, 2016) regardless of their actual competence. The issue of teachers’ self-efficacy cannot be overstated as a teacher’s belief, or lack there of, in their own ability to effectively use technology within the classroom is a major indicator in their choices around classroom technology use (Albion, 2001).

**Technology training.** Evidence from the research shows that subject area technology training can increase a teacher’s self-efficacy, in return having a positive effect on technology integration within the classroom (Hartell et al., 2014; Hill et al., 1987; Tsitouridou & Vryzas, 2004). Hartell et al. (2014) made the connection between technology training’s ability to increase teachers’ self-efficacy as it pertains to technology being used in the classroom. Increases in technology integration and teacher self-efficacy could be made through technology training such as master-level lessons or self-modeling experiences (Willis et al., 2016). Hill et al. (1987) explains that perceived efficacy with computers plays an important role in a teacher’s decision to use computers and technology within the classroom. Research also indicates that teacher’s views are shaped by not only their knowledge and use of computers but also by the training they have received (Tsitouridou & Vryzas, 2004). Hartell et al. (2014) found that there was a substantial difference between teachers who had received training and those who had not with respect to their perception of their own ability to use technology to teach. This study also found that teachers trained in technology experienced greater confidence in helping
students understand technology integration, achieve in the area technology, and offer
direction for students to follow moving forward. Hartell et al. (2014) make the
connection between subject area training, like technology, and the positive effect it has
on teacher’s self-efficacy and teaching using technology. In general, the research shows
that subject area training in technology aids self-efficacy and teachers’ belief in their own
ability becomes a major contributor to technology use within the classroom.

Within the literature it is seen that technology-centered student teaching
experiences also increase pre-service teachers’ self-efficacy as well, thus increasing the
chance that they will use technology within their classroom (Han et al., 2017). It is also
important to consider pre-service teachers because, as with attitudes, self-efficacy beliefs
can be hard to change once they are established (Tschannen-Moran, 1998). The research
tells us that with the rigidity of self-efficacy beliefs, the need for scaffolding during pre-
service teacher programs is required in order to build skill and confidence when using
technology within the classroom (Lemon & Garvis, 2013). New teachers will bring with
them the confidence that they develop and their sense of self-efficacy will influence not
only their level of technology integration, but also that of their students and colleagues
(Lemon & Garvis).

Professional development. Empirical evidence from the literature shows that
professional development positively impacts teachers’ self-efficacy (Albion, 2001;
DeSantis, 2013; Ritzhaupt et al., 2012; Yerdelen-Damar et al., 2017). The literature
shows that a school’s level of professional development significantly impacts a teacher’s
use of technology in the classroom (Ritzhaupt et al., 2012), but there is also evidence that
teachers’ self-efficacy with personal technology use is linked to their self-efficacy with
teaching technology (Albion, 2001). Research indicates that improving teachers’ professional development is seen as one of the areas that can increase teachers’ adoption of technology within the classroom (DeSantis, 2013). Professional development provides teachers with experiences and skills they would not otherwise have and research tells us that the more experiences and skill teachers have with technology the higher their self-efficacy with technology will be (Yerdelen-Damar et al., 2017). DeSantis’s (2013) findings argue that in order to change teachers’ desire to incorporate technology into teaching there has to be an improvement in the “quality and effectiveness of teachers’ professional development… by tailoring it to meet the specific demands in local contexts” (p. 344).

As professional development is discussed in the literature, it is important to note findings that indicate that teachers at different levels in their careers have different learning needs so input from all the stakeholders is required as professional development programs are created and planned (Cannon et al. 2011). Adding to this are the findings of Russell et al. (2003) indicating that while newer teachers may be more comfortable with technology itself, they may not have a full understanding of how it can be used within the classroom and require further training on how technology can be used as an instructional tool while those further in their career with pedagogical knowledge need to be taught how to use the technology itself. Russell et al. (2003) provide a warning that just because current generation teachers may have higher confidence with technology itself, it does not mean confidence will automatically translate into technology being used in the classroom as it is only after teachers have become comfortable with the skills of teaching that they will put energy towards incorporating technology within the classroom.
It is suggested in the research that when planning professional development for teachers the most impactful outcomes occur when teachers learn from different settings, from colleagues, and from experts (Levin & Wadmany, 2008). Teachers’ self-efficacy with technology can be improved by supporting them with longer-term, collaborative, and scaffolded professional development (DeSantis, 2013).

All of these authors describe a professional development model that focus in on teacher needs rather than prescriptive plans that look at deficiencies in practice as defined by policy makers. It would be important to note that Anderson and Groulx (2005) did not find self-efficacy to be the best predictor of future use of technology within the classroom. Although it played a role, they found that subjective norms were far more predictive of technology integration. For this reason, we see the interplay between our attitudes, the cultures of our schools, and our self-efficacy and how it influences the integration of technology into the classroom. From these findings the need and importance of an effective professional development plan that addresses a larger demographic of teachers is seen.

**Discussion.** Teachers’ beliefs about themselves, in reference to technology, play an important factor in their motivation and decision to use technology within the classroom. The literature points toward the understanding that teachers’ self-efficacy impacts their use of technology within the classroom. Further to that, self-efficacy itself is impacted by the experiences teachers have in regards to technology. Paramount to positive self-efficacy for teachers is the training and professional development that they receive, which makes them feel confident in the skills and abilities they have for technology integration at their disposal. Paying attention to a teacher’s confidence when
using technology can offer insight into their desire to use technology within the classroom. Through the review, we begin to see the interconnectedness of our experiences, attitudes, and self-efficacy. Self-efficacy is best understood by listening to teachers and what they understand themselves to be capable of; developing professional learning around the areas of weakness they identify; sustaining their learning over longer periods of time; and allowing teacher’s to make connections with others as they endeavor to incorporate technology within the classroom.

**Conclusion.** The impact of teacher’s experiences on both their attitudes and self-efficacy shows the interconnectedness of their experiences, attitudes, and self-efficacy as it pertains to integrating technology. With these understandings we can begin to develop a plane that addresses how to integrate technology when there are so many factors at play. This plan will require a multifaceted approach to technology that addresses all aspects of technology including humanistic components that the teacher adds to the equation.

Due to the interconnectedness of teachers’ experiences, attitudes, and self-efficacy and their ability to either positively or negatively impact technology use in the classroom a technology implementation strategy needs to be developed that accounts and plans for the impact of the teacher on technology implementation. The literature suggests several considerations when developing a technology implementation strategy. In the next chapter, I propose several implications to be considered in the development of any technology integration study. These aspects include knowing your staff, extrinsic factors that need to be considered, and ways of changing intrinsic factors already developed by teachers.
Chapter 3: Implications of Teachers’ Experiences, Attitudes, and Self-Efficacy on Technology Use

Introduction

The literature reviewed in this paper provides evidence for the impact of teachers on the use of technology within educational spaces and provides backing for the approach I use with technology in my teaching context. Throughout my career as a high school Career and Technology Studies teacher, technology has proven to be invaluable in aiding the teaching and learning of subject content and engaging students within the classroom. The benefits I see in using technology and the reasons I engage in practices that include its use are based in the experiences, attitudes, and self-efficacy I have developed in regards to technology and are supported by the findings for the three research questions answered in the literature review of this paper. Those questions were how do teachers’ background and ongoing experiences with technology relate to their use of technology in their classroom, how does teacher attitude impact their approach to technology use in the classroom, and how does teacher self-efficacy around technology influence its use in their classroom?

In the following sections two topics are discussed: summary of findings from the literature review and implications to leaders when implementing technology initiatives. These two sections are the summation of how the literature, and the relevance of my personal and professional experience provide insight into best practices for technology integration within the classroom. These best practices are of importance to any technology implementation initiative within schools because they focus on the humanistic implications of teachers’ involvement in the process. I present a framework through which a technology implementation strategy can be developed pays consideration to the
humanistic element of teacher. These structures address the common reasons for teachers’ negative experiences, attitudes, and self-efficacy. This framework is approached from the viewpoint of an administrator’s role within the planning and implementation of any technology implementation plan. Using the literature brings to light the areas of major consideration of which administrators need to be aware when attempting to change staff views of technology for the purpose of increased technology use within the classroom. This project includes both proactive steps that can be taken and reactive steps that will aid in creating new, more positive views of technology use.

The ideas expressed below on how to implement technology effectively by addressing the human element should be used instead of traditional models that only provide a pedagogical rationale and technical training for the implementation of the suggested technology. It is not to say that these more traditional aspects are not important, but that a more holistic multifaceted approach is needed that encompasses more than the rationale and training aspects of integration. My experience as an educator has shown, more often than not, technology implementation is done with a sense or motivation driven by technological determinism, where the technology dictates what we do and the practices we choose (Oliver, 2011) rather than allowing our educational needs to dictate the technologies we use and the practices we engage in. When you pair my professional experiences with the empirical findings within the literature there is support for a multifaceted approach to technology integration. One that accounts for teachers’ impact on implementation; one that, when accounted for, could increase the effectiveness of technology integration.
The reason for presenting my project in a written form is because it is intended as a guide or implementation strategy when changes in technology are needed. Such a guide can be better expressed through a written document detailing the rationale of the suggestions provided within. This approach to technology integration is one that I have been applying within my school, is supported by the literature, and will be presented in the implications for technology integration sub-section. The approach will be divided up into the following sub-headings: knowing your staff, addressing extrinsic factors, and addressing intrinsic factors. However, prior to this I present a summary of the findings from the literature section.

**Summary of Findings**

Within the literature, evidence was provided that showed support for addressing a teacher’s impact on technology integration within the classroom. More specifically, by answering the three research questions; how does teacher background and ongoing experiences with technology relate to their use of technology in their classroom, how does teacher attitude impact their approach to technology use in the classroom, and how does teacher self-efficacy around technology influence its use in their classrooms; support for the following implications can be made. Teachers’ experiences, attitudes, and self-efficacy can have a positive impact for the use of technology within the classroom. This positive impact is best realized when care is used in guiding teachers’ experiences, the development of attitudes towards technology, and the confidence teachers’ have using technology. The strong evidence towards the impact these factors have on technology use within the classroom is the reason I suggest technology implementation strategies need to incorporate and understanding of the humanistic element.
Implications for a Technology Implementation Strategy

Within my district there is a push for technology integration but in many ways the technology itself is pushing change rather than educational goals turning to technology for increased return on investment. This has fuelled my interest in technology and the role it currently plays within education while also seeing the potential unrealized within our educational settings. When first looking into the impact technology has had on learning and education, many articles were painting a grim picture of technology’s effectiveness within the educational setting. With technology becoming so prevalent in society and the educational world this growing understanding of its mediocre impact on learning shifted attention away from the specific technologies being used and moved to the process of implementing technology within a school. With the idea in mind that educators have the most control over what they do within the classroom, I began to focus on understanding how the attitudes, experiences, and self-efficacy of teachers shape the way in which technology is embraced or taught. Based in the research findings and my personal and professional experiences, the following areas will be reflected upon and discussed: knowing your staff, addressing extrinsic factors of a technology implementation strategy, and addressing intrinsic factors of a technology implementation strategy. To address knowledge of staff I will…To address extrinsic factors I will discuss infrastructure, technical support, access to technology, and district partnerships. To address intrinsic factors I discuss creating change, professional development, addressing rigidity, and pre-service teacher programs. The goal of proper care being used in an implementation strategy is to create positive experience with technology that develop positive attitudes towards its use, and having teachers feel confident in their own ability to use technology within the classroom, ultimately trying new ways of teaching with
technology. If this can be done, technology use almost becomes a self-propagating endeavour where effective implementation and use breeds more implementation and use of future technology.

**Knowing Your Staff.** MacArthur and Malouf (1991) show how teacher technology use is influenced by the attitudes they have about computers and technology. For this reason, knowing your staff is paramount before attempting any technology implementation strategy. By knowing your staff you understand where their attitudes towards technology lie. You may not fully understand how they developed these attitudes but through conversation you can gain a great deal of insight into how they think about technology and their willingness to attempt using it. The goal here is to begin a process of shifting away from negative attitudes towards more positive ones that create a desire to integrate technology within the classroom (Domingo & Gargante, 2016). Through my experience as an administrator, I have had the opportunity to discuss technology with my staff. You begin to hear comments, either through group or private conversations, like “we have tried that before”, “another district initiative”, or “more time spent doing something that will just change next year.” Such comments, while hard to hear, provide insight into where your efforts need to be directed. These comments indicate a negative attitude towards the way in which technology implementation is rolled out. Comments such as “do we have enough computers around the school to do that” would indicate an access problem. Either way, you gain the understanding of what negative attitudes have developed, how deeply these beliefs go, and which teachers are struggling because of their lack of knowledge in the use of technology. The understanding that a leader gains by listening to, and getting to know their staff will guide how they approach technology
integration and allow them to know where they need to begin their work to implement technology effectively.

**Addressing Extrinsic Factors of a Technology Implementation Strategy**

First, I want to address the factors that influence barriers extrinsic to the teacher. These first order factors that lie outside of a teacher’s belief system are far easier to address and have far less convoluted answers than the second order factors contained intrinsically within teachers. While these extrinsic barriers may have some effect on the attitudes and self-efficacy of a teacher, their influence is predominately contained within a discussion about the ease of technology’s use and not the quality of integration itself.

**Infrastructure.** Infrastructure is one of the foundational components that needs addressing before ever moving forward with technological implementation. This is solely due to the fact that any technology is only as good as the foundation it is built on. When I speak of infrastructure I include data wiring, established networks within the school, data servers, and access to the Internet through LAN lines or WiFi. You could purchase the best laptops or Chromebooks for any integration project just to be hindered by the lack of hard wiring or WiFi capability and bandwidth within the school. Throughout my career I have been involved in new technology initiatives that have ended poorly where the technology itself is set aside and ignored because of the lack of infrastructure and not because the technology itself had no use or merit within the classroom.

Throughout my career, I have been one of the teachers leading the way when it comes to using technology within the classroom mostly because of my own personal interest in technology and the fact that I have a background in it with my minor during my B.Ed. being Instructional Technology. I have had the opportunity to pilot many new
initiatives within the district such as grading programs, digital medial software, Virtual Reality uses within the classroom, and Google Educational products. Most of these projects, while involving a great deal more work, were still exciting as we attempted to aid student learning and engagement through the technology at our disposal. It was not until I was part of implementing the Google Educational products at a new school where I experienced the negative influences poor infrastructure has on technology use within the classroom. The school to which I moved had a data wiring issue with the building that made WiFi slow and unreliable. It even affected hardwired connections that made using the Internet for educational purposes time consuming and frustrating. This was also paired with the understanding that more district initiatives were being rolled out that relied on web-based products. This combination of web-based initiatives and a lack of web access within the school became a barrier for teachers to attempt any new technology regardless of its actual value.

This was the situation that I walked into and it became extremely evident that teachers had given up on using technology within their classrooms for what they saw as more traditional, tried and true, and reliable practices. As Hur et al. (2016) explain, due to poor infrastructure, negative experiences with technology use within the classroom were dictating teachers’ choices around technology use. The poor infrastructure that had not been addressed since the opening of the school in 1993 had created the poor attitudes towards technology that left teachers disappointed in the exact way Sahin et al. (2016) describe in their research. It was not until the infrastructure was addressed that the very slow process of changing teachers’ attitudes and experiences could begin. It must be noted that the ability to deal with infrastructure within a school is not an individual
endeavour or fast process. It requires a good relationship with district stakeholders that bring people to the table for the purpose of better student learning. These partnerships will be discussed later in the paper.

**Technical support.** While it is the hope that all technology works perfectly it is rarely the case. This is where technical support for teachers becomes critical. Professionally as teachers we are asked to be experts in teaching and learning. Technology can be a huge aid to both of those demands but teachers cannot also be expected to be experts in every technology they use such as, creating school networks, printer driver protocols, or getting programs to talk with each other to share attendance or assessment data. Technology is a powerful tool to be used in the classroom for both teaching and learning but the challenge is making sure that teachers are supported in a way that it works seamlessly to accomplish their desired learning objective. One individual who has guided my understanding of technology support for teachers says their job as a technician is to go as unnoticed as possible because the technology in the school should seamlessly integrate into the practices teachers have within their classroom. From my experience, good technical support is rarely truly appreciated as most issues are dealt with proactively before teachers are aware of any problems.

This level of support does come at a cost to the school and/or district to have technicians available within the school. From my experience, the approach that my district has embraced works extremely well as there is a part time in-house technician that deals with hardware and software issues while also having a call-in help desk of technicians when the in-house person is working at another site. Hur et al. (2016) and Sahin et al. (2016) would support such a model as budgets are allocated in a way that
make sure staff always feel supported since there is someone to address the technical issues they are facing in a timely manner. Close working relationships between technicians and administration and the technicians’ proactive nature in dealing with new technology rollouts have an extremely positive impact on teachers’ experiences with technology. Teachers’ level of access to such support greatly improves their attitudes towards trying new technology and their confidence in their ability to successfully attempt using technology within the classroom successfully.

**Access to technology.** Adequate access to technology has a great deal of impact over teachers’ experiences, attitudes, and self-efficacy. A lack of technology limits the quantity of interactions or opportunities to use technology within the classroom. A lack of technology within a school also affects teachers’ ability to develop self-efficacy with technology due the cyclical nature of self-efficacy suggested by Tschannen-Moran et al. (1998). If there is inadequate technology available for use then teachers do not get as much exposure to using technology within the classroom, thus they do not develop the needed self-efficacy to be persistent, thereby creating better performance, and ending with greater self-efficacy. Through my experiences I have found that access to technology is a double-edged sword because it is often for completely legitimate reasons that teachers have negative experiences and develop pessimistic attitudes towards technology’s use within the classroom but also becomes an easy excuse not to use technology in an attempt to hide larger underlying issues, attitudes, and fears around technology. It is much easier for teachers not to use technology and blame its limited availability as the causal factor for not changing practice than it is to address such internal factors as rigidity in practice, a lack of willingness to try new things, lack of
desire to put forward increased effort to learn new technology, or the lack of confidence teachers have in their abilities with technology.

My time as an administrator has highlighted a few cautions of which to be aware when creating more access to technology through its purchase. The first caution is that of timing. When the infrastructure issues were first diagnosed within my building and the lengthy process of creating a plan to remedy the situation started, it was decided that no more new technology would be added to the system. This was largely due to the fact that the system could not handle the increase in devices needing access to the system, but more importantly it was due to the understanding that the purchase of more technology would only cause more frustration in teachers. If more access to technology was available, logically teachers would want to take advantage of the opportunity, but due to the infrastructure any attempted use would be in vain and end with the creation of more poor experiences, negative attitudes toward technology, and self doubt in the teachers own ability to use technology within the classroom. In this way, access to technology has to be paired with equal levels of teacher support and infrastructure within the building to allow the system to work seamlessly in the same way that it did with less demand on the system and access to technology.

The second caution is around choice and teacher input into access to technology. Through my years as an educator I have seen thousands of dollars spent on technology that leadership see as cutting edge and the tip of the sword when it comes to educational practice but if teachers are not part of building that vision or buy into the same understanding then all is for naught. Money gets spent on technology that goes unused because teachers had no input into the purchase of a technology that they would have
argued against. This is not to say that teachers are the drivers of all technology initiatives and have ultimate control over the purchase of technology. The larger understanding is that in order to create positive experiences, attitudes, and self-efficacy with access to technology a balance between pushing the boundaries and having teacher input is needed.

Again, we see that when addressing such first order barriers as access to technology, many of the answers come with the easy solution of spending more money. While that solution is easy to understand it is far harder to implement with the tight budgets with which schools work and increased financial rules imposed by governments. Within Alberta the most recent scrutiny over school fees only adds to the decreasing funds available for the purchase of technology. For this reason, adhering to the findings of Sahin et al. 2016, any technology implementation strategy should involve planning for budgetary implications incurred by the school.

**Districts partnerships.** While district partnerships are not directly addressed in the literature they are worth discussing as part of any successful technology implementation strategy. In order for such issues of infrastructure, technical support, and access to be remedied, district leadership consultation is needed as they hold much of the decision making power over facility issues, district support staff, and monies for such projects. These partnerships can prove to be invaluable when larger scale changes are needed to remove barriers for the use of technology by teachers in the classroom. Taking time to build these partnerships will help garner the support to take on the extrinsic challenges of your building with the goal of making sure that negatives experiences, negative attitudes, and poor self-efficacy are not developed within your staff.
Another aspect of district partnerships that is required is in the creation of a vision for technology within the district. In the same way that teachers like to have input into the choices around technology that are happening within the school, school leadership needs to take advantage of opportunities to provide guidance to district planners and leaders about what is needed by schools. In my experience, when opportunities to have input are not provided, technology initiatives are driven by technology and not the educational goals of a school. People with technical knowledge make decisions based on their knowledge and not necessarily from an educational background. While such decisions are usually met with general acceptance in a minimalistic way, they do not provide lasting change within the classroom or on the potential for learning. These experiences are backed up by Baek et al.’s (2008) findings that as teachers increase in experience their technology use is only increased when there are outside pressures. It is a bad combination when non-educational beliefs are making decisions about technology in the classroom only to be reinforced by teachers due to pressure from central office. Not only that, but Baek et al. also found that this type of integration only engages in the simplest forms of technology’s use rather than more advanced features that may have more to offer an educational environment. Outside pressure can be used as an initiating factor for teachers to use technology in their classrooms but it must be founded on an educational vision for technology’s use in order that the potential within its use grows past the simplest features.

Throughout my career, these partnerships have been invaluable as they create a path of open communication between planners and the classroom. They create a situation where schools feel supported and influence the creation of technology policy; both of which are found to be instrumental in developing positive experiences and attitudes in
regards to technology’s use (Blackwell et al., 2014). These partnerships for added support also make technology use within the classroom seem easier and more attainable, which is another element that aids in creating positive experiences and attitudes (Anderson & Groulx, 2015).

District technology policy is worth noting within this section as district leaders are the ones that set the policies in place. With the evidence showing that poor policy being a cause for negative experiences and decreased use of technology (Blackwell et al., 2014), these partnership again provide an opportunity for meaningful change. Being engaged with district leaders in the creating and execution of policy can have a huge impact on teachers’ experiences and the attitudes they develop around technology’s use in the classroom. Administrators must bring their school’s needs to the table to be discussed for the possibility of positive district technology policies to be created and enacted.

**Intrinsic Factors of a Technology Implementation Strategy**

Moving on from the extrinsic factors we have to address how to go about influencing the intrinsic barriers teachers have to overcome with technology such as the attitudes they hold and the confidence they have within themselves to integrate technology effectively within the classroom. While the extrinsic factors discussed above can create negative experiences, develop negative attitudes, and promote poor self-confidence, this section looks at how leadership can begin to shift pre-existing intrinsic beliefs.

*Creating change.* Technology integration would be much simpler if teachers approached its integration without pre-conceived ideas and attitudes about technology, which must first be accounted for and understood before creating change. Instead, they
come with a history that has shaped their view of technology use within the classroom, and its usefulness, which guides their decisions around technology. Through my years as an educator, I have experienced many technology integration initiatives that did not seem to work or provide lasting change. At the time, I did not understand the reason for the lack of meaningful changes in practice but have now come to realize it had little to do with the technology but rather with the teachers’ willingness to engage in integration. Most of these initiatives were top-down approaches directing technology’s use within the classroom without addressing where teachers’ attitudes currently lie. Regardless of how many directives were stated, few made lasting changes in the classroom. Attempting to change teacher attitudes towards technology is what was needed because it could have lead to a more effective and efficient technology integration strategy being created that would provide lasting meaningful change to technology’s use in the classroom (Kim et al., 2013). This process of change, while being more effective, can sometimes take a longer period of time as it seeks to change the inner beliefs teachers hold towards technology and education, so patience is needed. This can be hard to do as technology is changing at such a fast pace and time comes at a premium with other educational demands and heavily packed curriculums.

The first step of this change process is to address the extrinsic factors as discussed above. By adequately addressing extrinsic factors, they no longer prevent teachers from having positive experiences with technology due factors outside teachers control. Once we are only dealing with factors within the teachers control, leaders can begin exposing teaches to simple tasks associated with technology integration to begin a shift towards a more positive view of technology’s use. Ertmer (2005) provides evidence of this
strategies effectiveness by indicating that beginning with high-end goals decreases effectiveness. My experience with implementing technology within a school suggests that as teachers begin to have some success with technology, even though it is limited, they begin to soften their negative attitudes towards technology creating an openness to its use that would otherwise not have been.

A second strategy I suggest is to find teachers within the school who already have a certain technical expertise and positive attitudes for technology’s use within the classroom. These teachers’ can be leveraged as champions for technology integration in a few ways. Firstly, in my experience, these early adopters begin to create a culture between colleagues within the school that promotes technology use within the classroom. Evidence within the research shows that a positive culture and social norms can work towards the aims of technology integration affecting teachers’ willingness to engage in technology use (Anderson & Groulx, 2005). In many ways such a culture and social norms become a form of teacher support as it creates a sense that they are not alone in attempting to use technology within the classroom and that there are people they can turn to for help when needed. Secondly, people whom teachers see as influential influence their beliefs about technology (Sadaf et al., 2012) creating a situation where those relationships can be used to instigate changes in technology’s use. Early adopters of technology within the classroom can serve as motivators for changing the beliefs and practice of reluctant teachers if care is taken in guiding influential staff to be early adopters. Lastly, while the research shows that effective modeling can work to change pre-service teachers beliefs around technology (Hsu, 2013), I have also seen effective modeling to work between colleagues as well. Many teachers, especially those
overwhelmed by the use of technology, can benefit by seeing it used by another teacher. As teachers model effective use of technology within the classroom and show that it is not as daunting of a task to undertake, more reluctant teachers attempt to use technology even in small ways. It is the job of a school’s leadership team to make sure that these small attempts are met with success to help the process of changing teachers’ attitudes towards technology through the creation of new positive experiences.

A third strategy for changing the negative attitudes of teachers is by providing a scaffolded approach to technology use within the classroom in order that teachers attitudes have time to shift through positive experiences. Through my experiences with technology implementation, I have see teachers develop negative attitudes due to their belief in an all or nothing structure to technology. When technology is introduced to staff usually its whole array of capabilities are shown and discussed while teachers disengage with the technology due to its overwhelming nature. I suggest that technology integration strategies need to be implemented in smaller more manageable parts. Those early adopting teachers will pick up and run with technology regardless of the pace at which you work with the rest of the staff but this approach limits the possibility of reluctant teachers developing more negative attitudes towards technology due to their sense of being overwhelmed. Such a strategy was used most recently when implementing Google Education applications with my staff. The implementation started with the simple task of getting students, in this case the staff, signed up for a Google Classroom. After using this platform to run our staff meetings for a few months we began to implement Google Docs to staff meetings so teachers could collaborate during staff discussions. Many small steps later we have most recently implemented another resource called Newsela that integrates...
into all teachers’ Google Classrooms and allows teachers to work on literacy initiatives regardless of subject area content. In this way administration has used modeling and a scaffolded approach to help teachers learn and integrate Google Education applications in their classrooms and teaching.

As these strategies are implemented and leveraged through technology initiatives, a culture within the school should start to take form where staff are willing to try new ways of teaching using technology with the hope of increased student learning. This culture will also allow for some failures with technology use, which a poor culture will not allow. In a positive culture a failure is seen as valuable experience and a reason to try a different approach, while a poor culture will only use it as more evidence for why they hold negative attitudes towards technology.

**Professional Development.** Just like the students in teachers’ classrooms, teachers need to have a degree of confidence in their own ability to use technology in order for them to choose to engage in its use in the classroom. The professional development that schools offer their staff is one of the best ways to influence a teachers’ self-efficacy with technology (DeSantis, 2013). Quality professional development involves incremental learning so that teachers can use technology and see that they are being successful in integrating it into their classrooms, similarly to the scaffolded approach discussed above when trying to create positive experiences using technology. I suggest that professional development be planned in a way that provides a multifaceted approach to technology’s use. It is known that teachers require different levels of professional development depending on their prior experience, history, and comfort level with technology (Cannon et al. 2001). Before any professional development is rolled out teachers should be
consulted in order that they have input into their learning as their needs as teachers must be discussed (DeSantis, 2013). Supported in the literature is the following approach to providing positive professional development.

Firstly, teachers need to be exposed to different settings or ways of teaching their content with technology. It is through these vicarious experiences that teachers begin to envision other, possibly more effective or engaging ways of teaching that incorporate technology. My experience has shown me that just telling teachers to do things differently does not work; they need to see the different ways of doing things in action and the benefits reaped from such approaches. A second benefit to professional development in seeing teaching done in a different setting is that it allows teachers to learn from each other. When the technology being used is demonstrated by someone who is in the same field and understands the educational environment from a very similar perspective, they hold a great deal more credibility for teachers than someone who has not been engaged in the classroom for some time. Learning from colleagues provides a demonstration of real world application versus theoretical practice. This approach also works as a form of perceived support as teachers will help and support each other when ideas are shared and others attempt technology integration that is already part of regular practice in another teacher’s classroom. In addition, paramount to learning from each other is the way in which differing experiences can become a shared collection of experience. By working together, teachers who lack in pedagogical experience but have a comfort level with technology share with those that have the needed experience but lack in their ability to use technology (Russell, et al., 2003). Getting teachers to share their
strengths creates professional development that will improve the quality of technology use within the classroom.

During my time as an educator, most technological professional development was delivered over the course of one or two days, which has been proven to be less effective than development that is spread out over longer periods of time (DeSantis, 2013). Typically, education technology education is approached with a sense of technical expertise rather than classroom application. I would suggest that providing professional development for technology involves not only giving teachers small amounts of practical skill but also the ability to go and apply those skills before moving on to more advanced practices. This builds confidence within the teachers and also allows for shifts in attitudes to occur as teachers self-efficacy grows.

While I have not provided any concrete program for providing professional development I have suggested a structure that places importance on considering the needs of teachers rather than the needs of technical expertise. This structure helps create the cyclical benefits of professional development where greater self-efficacy leads to greater persistence and effort, which creates more positive outcomes, leading to greater self-efficacy (Tschannen-Moran et al. 1998). By addressing the needs of the teacher when looking to implement technological change, not only are the needed skills created but attitudes towards technology change as well while teacher gain the confidence to use technology effectively.

**Addressing Rigidity.** The attitudes of teachers over time can become steadfast and near immovable unless great shifts in thinking occur (Pajares, 1992) regardless of persuasion in a positive direction (Ertmer, 2005). For leaders, this notion can become
quite daunting when looking to change teachers’ practice with technology. Through the research we see that the strategies that have been discussed thus far in this paper also help overcome such rigid thinking. It is in providing sustained incremental changes in practice, aided through support, and meet the needs of the teacher, that rigid beliefs begin to change. Even though the literature suggests that if you have a well thought out implementation strategy, very few changes are needed in order to loosen rigid beliefs and practices, in my experience, care is still needed so rigid staffs do not defeat or negate the best-intentioned technology implementation. A solid technology implementation strategy that follows the empirical and experientially supported suggestions in this paper is all that is needed to begin to address those stuck in a negative way of thinking with regards to technology.

To begin addressing rigidity, one step can be to use teachers’ own motives to your advantage. Having teachers use technology out of a perceived ease of use (Anderson & Groulx, 2015), a sense of convenience, or a reduction in needed time and effort (Baek et al., 2008) can be leveraged to allow teachers to have positive experiences with technology, slowly increasing the flexibility of otherwise steadfast beliefs. These motivators may be the initial reason for rigid teachers to engage in technology’s use, as it provides personal benefit, but as these first attempts at technology are met with success rigid teachers can begin the change process.

Being proactive in the development of the attitudes and beliefs teachers hold about themselves and their abilities is another suggestion brought forward. Based on Han et al.’s (2017) work, leadership providing pre-service and newer teachers with positive role models that embrace technology within their classroom, modeling practices that take
advantage of technology, and engaging them in activities that develop their own confidence with technology are all steps towards limiting the development of negative attitudes and beliefs before they become core to how teachers view themselves. The attention of leadership is needed by those early in their careers to promote the development of positive attitudes and self-efficacy by providing positive experiences with technology for these teachers. It is not to say that later career teachers are not deserving of as much time and care, but it is far easier to create positive experiences, attitudes, and self-efficacy than attempting to change them once they have become core to a teachers’ belief system.

**Pre-service teacher programs.** It is important to note that a great deal of research shows the influence that pre-service teacher programs can have on up coming teachers’ beliefs, attitudes, and self-efficacy. Within Alberta there seems to be a lack of input from classroom teachers into pre-service teacher programs. While universities make the decisions about what is offered through their programs I suggest we not lament what we cannot control. As administrators, we can control the teachers with whom we pair pre-service teachers. Evidence shows that being paired with a teacher who embraces technology within the classroom can have a huge impact on the university student’s attitudes towards technology once they enter the classroom. This has been confirmed most recently through a discussion with a former practicum student. They shared with me that one of their practicums was with a teacher that embraced technology and one was with a teacher that did not. Upon reflection, the level to which this teacher integrated technology within each practicum was drastically different as their views towards technology’s usefulness in the classroom changed with the influences of their mentor
teacher. Another suggestion to aid pre-service teachers in the positive development of their attitudes towards technology is to allow for intentional guided reflection on the attitudes they are developing towards different aspects of teaching, because as research suggest teachers attitudes do not automatically change with positive experiences. It is through reflection about how what they are learning challenge their existing beliefs and their mentor teacher’s decisions making process that allows them ability to move away form negative attitudes and beliefs (Hsu, 2013).

**Conclusion**

Through the implications section of this paper, suggestions on how to structure a technology implementation strategy have been presented. These suggestions have been based on the empirical findings of the literature and my professional experience that indicate that a more humanistic and multifaceted approach to implementing technology needs to be embraced to increase the successfulness and longevity of teachers using technology within the classroom. By addressing the role teachers’ experiences, attitudes, and self-efficacy play in using technology in the classroom, we increase teachers’ willingness to engage with new initiatives and positively impact student learning.

By answering the three questions in the literature review, the impact that teachers have on technology use within the classroom that move beyond what specific technology itself is shown. The findings indicate that the impact of the teacher’s experiences, attitudes, and self-efficacy is far more influential than the benefits of a technology presented in a presentation or professional development session. The literature directs us towards the importance of addressing the negative beliefs teachers hold about technology so that technology use within the classroom is judged on its merits and impacts on
learning rather than the beliefs teachers hold about technology from past negative experiences.
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