

Running Header: BARRIERS AND WORKAROUNDS FOR TECHNOLOGY INTEGRATION

Perceived Barriers and Workarounds of Integrating Information and Communication
Technologies into a K–12 Classroom

By

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Dedication

I would like to dedicate this paper to my supportive wife, Alyssa, and my beautiful daughter, Grace. Without your love, support, and encouragement I would not have been able to succeed in this accomplishment. I would also like to thank everyone who has spent countless hours helping me edit my writing, and Adam for helping me throughout this journey. Finally, I would like to thank the advisors and the professors from the University of Victoria, as well as all the cohort members with whom I shared an incredible two years of learning. Thank you.

Abstract

This project presents a general background in the perceptions of the barriers that educators face when trying to integrate modern-day technologies into their classroom. After a brief introduction that includes a personal account and the significance of my topic, the literature review provides a detailed background of the barriers, as perceived by teachers, that are faced when integrating technology into their classrooms. Focusing on both internal and external barriers that teachers face, I also look at potential workarounds for teachers, administrators, and a district's head office, for the barriers that are revealed. My project focuses on what an administrator could do to help promote a positive pedagogical shift for teachers who are reluctant to incorporate technology into their classrooms.

Keywords: technology, barriers, integration, classroom

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Chapter 1

Personal Interest

I have been interested in the field of technology since I was young. Fortunately, my parents recognized and fostered this interest, to help my passion in this area grow. Throughout my schooling, I took all of the technology courses that were offered, but often found them underwhelming, therefore the majority of my knowledge in the area is self-taught.

My passion for the use of technology in education began while I was studying Education at the University of Alberta. At this time technology had made a surge, and it was apparent that it was a trend that wasn't going to fade away. Technology was growing at a speed that made it hard to keep up with; it began finding its way into every aspect of life. Regardless of one's career choice, it would be part of the work place.

I noticed that individuals with whom I was studying were struggling with the most basic features of technology. They had difficulties with both technologies that would be necessary for their future jobs, as well as technologies designed to simplify complicated tasks. This struggle concerned me, as I believed that technology was going to be deeply embedded in the future of education. The integration of technology in classroom practice would be a very important skill for an educator to have, as it would be a skill that every single student would require for the future.

When I started my career as a mathematics teacher in a junior high school, I very quickly realized the extent to which students had already immersed themselves in technology. Thus, I began to wonder, how can I integrate the use of technology into my classroom to increase student motivation and hopefully positively impact their achievement? Throughout several years as a classroom teacher I found great success integrating technology into my classroom. I was

able to successfully create and pilot a Video Game Design course that had direct links to the mathematics curriculum that I was also teaching.

I have now transitioned to the role of an Assistant Principal at an elementary school. My passion for technology has not changed, but I have shifted my focus. I am no longer striving to create a technology-rich environment for my students but trying to show the teachers in our school the benefits of a technology-rich classroom. The use of technology at school, not only affects the student's attitudes towards school, but also their potential achievement. Thus far, I have met some resistance from teachers, but the resistance has been coupled with a willingness to jump outside of their comfort zones to do what is best for students.

Current research shows that if students are placed in a technology-rich classroom, there isn't a strong correlation with increased student achievement. The factor that contributes to an increased rate of achievement is the teacher's pedagogical belief about the integration of technology into the classroom; if educators believe in the technology that they are integrating into the classroom, then students will be more likely to benefit from it. This research has helped me develop my new area of interest in technology: teaching individuals about the positives of technology and guiding them to having positive experiences with it. My hope is that by helping my fellow educators increase their knowledge about technology and having some positive experiences with it will help them shift their pedagogical stance from negative to positive.

Significance of the Topic

Information and Communication Technology (ICT) is a field that has been exponentially growing each year. In the early 1990's it was rare to see a personal computer in an individual's home, were as in 2015 Statistics Canada reported that approximately 87% of Canadian homes

have access to the internet (Statistics Canada, 2015). For the majority of Canadians, technology is now in in our homes and in our workplaces every day.

With technology being so prevalent in our lives, I believe that our teaching needs to prepare them for the environment in which our students are going to be part of when they have completed their schooling. Not only will we be helping students become more engaged with the curriculum that is being taught (Camilleri, & Camilleri, 2017), but it has been shown that teachers with a strong pedagogical belief towards the integration of technology have a positive impact on student perceptions of technology. This belief, in turn, has a positive impact on student achievement (Peko, Cantieni, & Prasse, 2017; Simona, Marco, Federica, Laura, & Gianluca, 2016; Tingir, Cavlazoglu, Caliskan, Koklu, & Intepe-Tingir, 2017).

There is a proven positive benefit for the integration of technology for our students while they are in school, which I believe would continue as they transition to work. Businesses say that students lack the basic knowledge of technology when trying to enter the workforce (Webster, 2017). Therefore, if we integrate ICT into classrooms, not only will we be providing students with positive benefits while they are in school, but they will be more prepared to enter the workforce when they are leaving school (Davidovich, Nikolay, Laugerman, & Commodore, 2010). If we ignore the prevalence of technology, and do not change the way that we teach our students, then we will be doing them a disservice (Ardies, De Maeyer, & Gijbels, 2015).

Research Path and Strategies

When performing my research, I predominantly used Web of Science, and the ERIC database, but also made use of the University of Victoria's Library's search engine, as well as Google Scholar. I started my research using the terms "technology" and "education". These search terms produced several thousand results, the majority of which had no relevance to the

topic that I was researching. Therefore, along with “technology” and “education”, I added the search terms “student achievement”, “teachers perception”, and “perceived barriers” to limit the number of articles that were found. When I was looking specifically for articles that showed the impact of technology on student achievement I combined the words “education” and “student achievement” with the top keyword of “technology”. While I was looking for articles that focused more on the teacher's perception of technology integration, I added in extra keywords such as “teachers perception” and “perceived barriers”. To further narrow my search, I limited the majority of the articles I chose to those that have been published in the past five years. When studying the field of technology, I thought that it was important to limit my search to more recent articles as technology is changing at such a rapid pace that any article beyond this time frame could be considered out of date. I did occasionally use articles and studies that were beyond this time frame but ensured that the information that was presented in them was still relevant. To finalize my choice of articles, I read through the titles that were found to see which were pertinent to my research question, and if appropriate would read the abstracts. If the articles were suitable, I reviewed the methods section to ensure that it was an empirical study.

When selecting the articles to use for my literature review, I chose articles that related very specifically to my topic. There are several articles that link the use of technology in a classroom to student achievement, however, I was able to narrow the articles down to ones that specifically talked about the teachers’ acceptance and comfort level with the technology that was used in the classroom. I chose these articles because I am very interested in researching the difference between classrooms that integrate technology because the teachers feel obligated to, and the classrooms where teachers integrate technology because they want to.

Definitions

The following terms will be used in this paper with the following definitions:

Technology – a wide range of different devices, such as desktop computers, laptops, tablets, handheld devices, smartphones, interactive whiteboards, as well as applications, or educational approaches that can be used to aid students (Petko, Cantieni, & Prasse, 2017).

Information and Communication Technologies (ICT) – A term that is used synonymously with technology.

Mobile Learning Devices (MLD) – A specific group of technologies that are portable. Technologies that fall into this category are, laptops, tablets, smartphones, and other handheld devices.

First-Order barriers – These are barriers that are external. In other words, these are barriers that teachers face when implementing technology in their classrooms. First order barriers include such lack of physical resources, insufficient time to plan and prepare, infrastructure problems or a lack of support when issues arise when working with different ICT (Ertmer, Paul, Molly, Eva, & Denise, 1999).

Second-Order Barriers – There are barriers that are internal to teachers focusing on the implementation of technology in their classrooms. Included in these barriers are the issues of a teacher's pedagogical beliefs about the implementation of ICT, or a teacher's skill, knowledge, and ability level with ICT (Ertmer et al., 1999).

Chapter 2

Introduction

The use of technology in the classroom is currently a trending topic in education. There are many studies that critically review all aspects of the use of Information and Communication Technology (ICT) in the classroom. One common theme that emerges from the literature, is one of the most important factors for the successful integration of technology in a classroom is the teachers' pedagogical beliefs about technology (Camilleri & Camilleri, 2017; Comi, Argentin, Gui, Origo, & Pagani, 2017; Ertmer, Ottenbreit-Leftwich, Sadik, Sendurur, & Sendurur, 2012; Kim, Kim, Lee, Spector, & DeMeester, 2013; Montrieux, Raes, & Schellens, 2017; Nel, 2017). In order for students to experience success with ICT in the classroom, they must have a leader who believes in the tools with which they are teaching and is willing to use technology as more than just a "book behind glass" (Montrieux et al., 2017, p. 268).

Even knowing the importance of a positive pedagogical stance, there are still several teachers who are resistant to the technology movement. These teachers have a negative perception of technology and are resistant to the integration of ICT in their teaching. In this literature review I look to provide answers to three specific questions: (a) what are the main reasons that influence teachers to have negative beliefs about the use of technology in the classroom, (b) what can be done at a school level to help change teacher perspectives of technology, and (c) what can be accomplished at the district level to aid in this endeavour?

Defining Technology

"Technology" is a term that is used to describe a wide range of different devices, applications, or educational approaches that can be used to aid students (Petko, Cantieni, & Prasse, 2016). These technologies can either be used directly by teachers, or students, within the

traditional classroom or can be accessed and used outside the classroom in other educational settings such as a maker space lab, or a learning common. Some examples of technologies that fall under the umbrella of “technology” would be, digital whiteboards, desktop and laptop computers, tablets, smartphones, software programs, the internet, social media sites and platforms, computer-supported learning, flipped classrooms, or game-based education.

Because the term ‘educational technology’ covers such a broad range of approaches, it has led to extensive research in the field. The sheer number of different technologies available, coupled with the idea that any of these technologies can be “used differently by different people and in different contexts to solve different problems or to achieve different goals” (Lei, & Zhao, 2007, p. 286) makes the ideas and possibilities around technology almost endless.

The term “technology” is the one that is used most commonly throughout the reviewed literature. Other terms such as Information and Communication Technology (ICT), and Mobile Learning Devices (MLD), are also commonly used to describe these technologies or a more specific subset.

Technology in Education

Achievement. When looking at the use of technology in classrooms, its effectiveness is often directly correlated with student achievement. If using technology is worthwhile, then we should see an increase in students’ achievement (grades) where technology is implemented.

A review of the empirical studies completed in this area, does not provide clear answers to the relationship between technology and achievement. There are several studies that have been conducted (Cristol & Gimbert, 2013; Kazu & Demirkol, 2014; Olsen & Chernobilskt, 2016) that show technology positively influences student achievement. At the same time, there are just as many studies (Comi et al., 2017; Cristia, Ibararan, Cueto, Santiago, & Severin, 2017; Skryabin,

Zhang, Liu, & Zhang, 2015) that show that technology does not change the level of student achievement, or in fact negatively impacts student grades.

A careful review of these research articles reveals that there are many things that need to be considered; one of the most important being the educator who is leading the class. Having a teacher who has a positive pedagogical belief towards the use of ICT in the classroom can be the strongest indicator of increased academic success for students (Camilleri, & Camilleri, 2016; Montrieux et al., 2017). Educators need to be able to understand technology and be able to integrate it in a meaningful way to enhance student learning experiences (Comi et al., 2017; Nel, 2017). If this is accomplished, then there is the subsequent increase in student achievement that is believed related to the use technology.

This improvement in achievement is best attained if teachers are able to create what is called a “blended learning environment” (Kazu & Demirkol, 2014). A blended learning environment is one where teachers are no longer the sole providers of knowledge; it is one where teachers play a more complex role of providing varied levels of support for students as they progress through different lessons and projects (Montrieux et al.,2017).

Teaching in a blended learning environment does not mean that students are constantly using ICT. Teachers play a significant role in knowing when it is best to incorporate technology into their lessons, and when it is best to rely on other teaching techniques. Having a teacher that is able to distinguish when it is best to use technology to enhance a lesson, and when it is best to use more traditional teaching methods is vital. Lei & Zhao (2007) conducted a study to prove that there is an ideal amount of time (in hours) that students effectively spend on computers and how it affects their Grade Point Average (GPA).

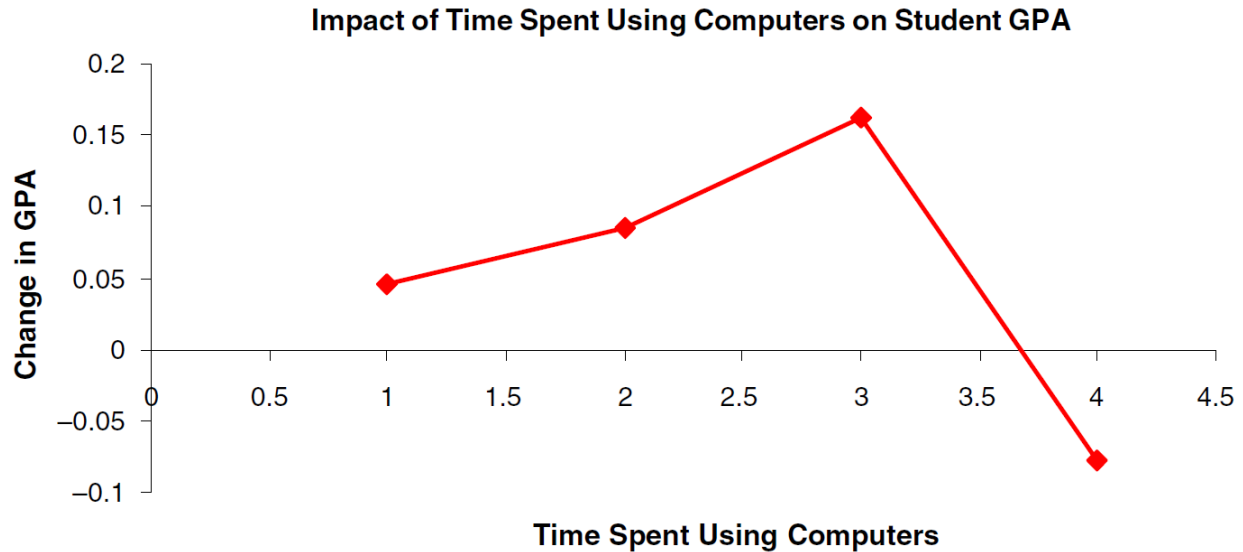


Figure 1. Impact of Time Spent Using computers on student GPA, from Lie, & Zhao (2007).

This study (Lei, & Zhao, 2007) showed that if technology was incorporated into the classroom appropriately, there was a positive impact on student GPA. However, when technology is implemented in a classroom there is a saturation point where too much time on computers is detrimental to student achievement. This finding indicates that it is up to teachers to determine when it is best, and most appropriate, to incorporate ICT into their lessons, and when it is more advantageous to employ more traditional teaching methods.

Beyond achievement. When considering the importance of integrating ICT into classrooms, it's important to consider other implications of technology beyond achievement. While student achievement is important, a student's academic performance should not be the only factor that teachers think about when selecting what and how to teach in their classrooms. Teachers need to consider the whole child when assembling lessons for their classrooms, and part of that consideration is the preparation of students for the future. Planning for the future includes thinking outside the confines of a formal classroom. Beyond teaching the curriculum

that is mandated by their provincial governing body, teachers also need to prepare students for careers that extend outside of what is mandated to be taught within their classrooms.

With the advancement of technology and its presence in all sectors of employment, from work in retail stores to Nano-engineering, businesses and industries expect workers to enter the workforce with a base level of understanding of foundational technological skills (Davidovich et al., 2010). As educators, it is our job to ensure that students have the opportunity to obtain these desired skills to prepare them for productive futures.

In a 2017 study, Al-Eidan found that the integration of technology in the classroom provided students with several benefits that extended beyond achievement. His study agreed with the study results of Davidovich, et al. (2010) and found that the innovation of technology in the classroom helped prepare students for the advanced workforce of the 21st century. His study found that the use of technology in project-based learning helps students retain information at a higher rate than traditional teaching methods. It also made individualized learning easier for the teachers as students could learn at their own level and at their own pace (McKnight et al., 2016). The benefits were increased differentiation, which made learning more meaningful and accessible for every student in the class.

Technology has also allowed teachers to connect with students in a way that was never possible before. With a majority of students' lives outside of the classroom being linked closely with technology teachers can easily become, and stay, connected with students and parents (McKnight et al., 2016). Using applications such as Remind®, or Class Dojo®, teachers are able to have a constant two-way line of communication with their students' parents. These applications also allow students to have a line of communication with their teachers when they are outside of the classroom and requiring assistance.

Barriers which Influence a Teacher's Perception of Technology

There have been several studies that examined why educators have a negative belief towards the use of technology in the classroom. Different researchers have created different labels for group these reasons, but when looking at them closely they are always categorized in a similar fashion.

Ertmer et al., (1999) separated issues that teachers faced integrating technology into the classroom into two separate categories and labeled them, “first-order” and “second-order” barriers. First-order barriers are extrinsic barriers that are faced by teachers such as lack of resources, minimal amounts of technical support, and the amount of time required to plan and prepare for lessons. Whereas second-order barriers are intrinsic issues that educators face such as a teacher's pedagogical standpoint, as well as a teacher's personal knowledge and skill level with the available technology.

More recent studies have been completed using these groupings to distinguish between barriers. Hew and Brush (2007), Carver (2016), as well as Al-Eidan (2017), have undertaken studies that use these categories to seek out why teachers have negative perceptions of the use of ICT in the classroom. Even though there are almost two decades between these studies, they both feature perceived barriers that are very similar.

While most studies that look at the barriers of integrating ICT into the classroom agree upon the categories of first-order and second-order barriers, there are studies that have categorized the barriers differently, including a study by Uluyol and Sahin (2016).. Uluyol and Sahin felt that by grouping what teachers perceived to be issues as an “individual” or “external” barrier, it would be easier to research and therefore understand why teachers had negative perceptions of the use of technology in the classroom. Although they had different categories for

these barriers, the results of their research were very similar to the studies that used the labels of first or second order barriers. The barriers labelled as intrinsic barriers included issues such as teachers' beliefs, attitudes, and views about the integration of ICT in the classroom. These mirrored the barriers that other studies labeled as second-order barriers (Al-Eidan, 2017; Carver, 2016; Hew, & Brush, 2007). While extrinsic barriers included the lack of physical resources, minimal technical support, the lack of time, and the lack of proper professional development (Uluyol, & Sahin, 2016); the exact same issues that were labeled as first-order barriers in other studies (Carver, 2016; Hew, & Brush, 2007; Al-Eidan 2017).

Even though different researchers have used varied terms to categorize barriers that are experienced by teachers when using technology in the classroom, a large majority of the barriers found in each of the studies overlapped. Throughout the rest of this review I will be referring to these barriers as either "first-order" or "second-order" barriers. I will also include research from different studies that did not categorize them in this specific way.

First-Order Barriers

First-order barriers are issues that are extrinsic to the teacher (Ertmer et al., 1999), and are constraints to the integration of ICT in the classroom. In several different studies, researchers have found that first-order barriers account for a majority of the perceived reluctance and negative attitudes towards ICT (Al-Eidan, 2017; Carver, 2016; Hew, & Brush, 2007; Liu, Lin, Zhang, & Zheng, 2017).

Carver (2016) identified that up to 76% of the perceived barriers to technology use could be directly linked to first-order barriers. Other studies provided similar results showing that first-order barriers comprise the overwhelming majority of the issues teachers experience when

integrating technology into the classroom. Ultimately, this lack of resources provides teachers with an adverse experience and aids in generating negative feelings towards the use of ICT.

Table 1

Teacher Perceived Barriers to Technology Use, from Carver (2016)

Total of 54 Barriers Identified	Number*	Percentage
Total First Order Barriers Identified	41	76%
Amount of Technology	33	61%
Location of Technology	3	6%
Amount of Instructional Time	3	6%
Availability of Support Personnel	2	3%
Total Second Order Barriers Identified	13	24%
Teacher Knowledge and Skills	13	24%

Studies that focused on barriers encountered by teachers while incorporating ICT into their classrooms identified numerous issues that teachers faced. In the study which produced the table above, Carver (2016) revealed 54 separate barriers that were identified by classroom teachers, 41 of these being first order-barriers. Participants in Hew and Brush's (2007) study identified 123 individual issues that were seen as barriers to the integration of technology in the classroom, seventy-nine of them being first-order barriers. When identifying barriers that teachers experienced while incorporating ICT in their classrooms, researchers often grouped similar barriers into common themes for the ease of the study. As we can see, Carver identified that a common first-order barrier theme was the "Amount of Technology", looking further within this category there were actually thirty-three identified issues. Even though it was only one of four categories that were identified in Carver's study, this category accounted for a majority of the first-order barriers that were experienced by teachers.

The four main "first-order" barriers that will be examined further are: the issues that teachers face in regards to the available resources, the physical institution in which they teach,

the time they have to successfully integrate ICT in the classroom, as well as their access to and the availability of technological support.

Accessibility of technology. One of the main first-order barriers encountered is the accessibility of technology for teachers and their students. The rapid advancement of technology makes it nearly impossible for schools to provide up to date technology for every student. Additionally, with the advancement in software, more powerful computers are required to properly run these programs, which schools are often unable to access. This discrepancy means that most of the technology that is currently in schools is unable to perform the required tasks. In fact, software development renders much of the current technology in schools obsolete. Therefore, schools need to purchase the up to date ICT in order to run the latest software; this is unfortunately not feasible for schools due to limited budgets.

The lack of accessibility to technology is very frustrating for teachers and leads to misdirected attitudes towards the integration of ICT in the classroom. Teachers often feel that even if they desired to use technology in the class to assist their students, they are physically incapable of doing so because they do not have the appropriate resources. Al-Eidan (2017) stated that in most schools, the technology was often found situated in a specific classroom or lab environment and that this centralization was not conducive to the effective integration of ICT. Even if the technology was successfully situated in a certain area of the school, several respondents reported “it was not easy to reserve computer labs or mobile devices for their teaching” (Liu, et al., 2017, p. 8).

Even when schools have access to technology, there is still frustration around working with ICT in the classroom. Educators who are open and willing to use ICT in the classroom still experience frustration with the lack of accessibility to the appropriate programs and applications

that they would like to use in their classrooms (Liu et al., 2017; Nikolopoulou, & Gialamas, 2015). Teachers find that even if they are equipped with the appropriate technology, quite often they do not have the programs or applications desired for the specific learning purposes that they wish to accomplish. In order for teachers to get the requested programs it often takes time and causes teachers to have more negative experiences with technology.

Teaching environment. The physical teaching environment was a common first-order barrier that teachers identified as a reason for the lack of use of ICT in the classroom. It was common among teachers as a barrier, but for several different reasons, all of which contributed to a negative attitude towards technology.

A common issue with the physical teaching space is an insufficient amount of technology required for proper implementation. According to reports from educators there are insufficient numbers of computers, MLD, or other peripheral technology (Karagiorgi, 2005; O'Mahony, 2003). Conversely, Liu et al. (2017) had participants in their survey indicating that they strongly believe that they are teaching in a positive environment that promotes the use of technology, but that the physical infrastructure of their building does not allow the use of modern-day devices. The age of the building, which often dictates the wiring within the building, does not allow for the appropriate bandwidth necessary for the smooth use of newer technologies. Even if students are equipped with the proper technology, quite often when all students log onto their devices everything comes to a stand-still and all potential learning is lost due to devices taking too long to load or being unable to log students on to certain devices or websites.

Time. Lack of time to implement new teaching strategies, or in this case new technology, in their classroom is a common first-order barrier that teachers indicated having (Ertmer et al., 2012; Hew, & Brush, 2007). With professional development days having a strong focus on the

use of ICT in the classroom, there are several different ideas and strategies for implementation available. But with full teaching schedules, commitment to extracurricular activities, and often families of their own, teachers struggle to find the time to take these ideas and make them a reality in their classrooms.

The research required, planning and preparation of lessons, as well as set-up and execution of appropriate lessons with the integration of technology all take time to complete. This is time that teachers find very hard to find with their other roles and responsibilities in their schools (Hew, & Brush, 2007)

Accessibility of support. Negative perceptions about the use of ICT in a classroom have also come from the lack of support that is readily available for teachers (Ertmer et al., 2012; Kafyulilo, Fisser, & Voogt, 2012). At professional development sessions, teachers are presented with several ideas to implement technology in their classrooms, however as they attempt to implement these plans into action there are always minor issues encountered. Frustration among teachers occurs when these issues cannot be fixed quickly and there is no one who is easily accessible to provide technical support.

Some teachers have reported that even for minor issues there is no one in their building who has the ability help (Al-Eidan, 2017). Usually it takes a phone call to an IT department, and several days, to have these minor technological issues resolved. These latency periods are very discouraging for both students and teachers and often lead to the use of more traditional teaching methods.

Second-Order Barriers

Second-order barriers are issues that would be intrinsic, or internal, to the educator (Ertmer et al., 1999). When teachers have been asked to identify barriers that are perceived when

integrating ICT into the classroom second-order barriers are not identified nearly as often as first-order barriers (Carver, 2016; Hew, & Brush, 2007). Carver believes the discrepancy is because teachers need to self-identify that they are the obstacles, and this is something that many teachers are unwilling or unable to do.

In Hew and Brush's (2007) study, of the 123 barriers that were identified by teachers 33% of them fell under the term "second-order barriers". The researchers divided the barriers further and found that teachers only truly identified two separate sub-categories: teachers' feeling that they lack the skill and knowledge required to integrate ICT and teachers' attitude and beliefs about the integration of technology into the classroom. A more recent study has shown similar results; 23% of the barriers that were perceived by teachers fall under the category of "second-order" (Carver, 2016). An interesting point about this part of Carver's study is that all the second-order barriers that were identified fall within the category of "skills and knowledge". No teachers in the study identified themselves as having a negative pedagogical stance toward the inclusion of ICT in the classroom.

Although, there are other studies (Blackwell, Lauicella, & Wartella, 2014; Kafyulilo et al., 2016) in which teachers do identify other second-order barriers. Two of the most significant second-order barriers that were identified in these studies are, the fact that teachers had negative pedagogical beliefs towards the integration of technology in the classroom, and that teachers believed that they lacked the skills and knowledge for proper ICT use. Compared to these two second-order barriers, all the other perceived second-order barriers are statistically insignificant and thus nominal in comparison. These other second-order barriers that were identified were issues such as teachers who serve students with a high socioeconomic status or the number of years that a teacher has been removed from their pre-service education (Blackwell et al., 2014).

In terms of student achievement and engagement, second-order barriers are more important to overcome than first-order barriers. Even if all the first-order barriers could be eliminated, students would not reap the benefits of a technology-rich environment if teachers do not believe in the positive use of technology or do not have the knowledge and skills to use the technology appropriately (Comi et al., 2017; Montrieux et al., 2017; Nel, 2017).

Teachers' pedagogical beliefs. A teacher's pedagogical belief, positive or negative, about the use and integration of technology into the classroom is the greatest indicator of its effectiveness. Several recent studies have proven that a teacher's pedagogical stance is the single most important factor when integrating technology in a classroom to improve student achievement and engagement (Comi et al., 2017; Montrieux et al., 2017; Nel, 2017).

Camilleri and Camilleri (2017) explored educators' attitudes and perceptions about the utilization of digital learning technologies in the classroom. They found that there is a relationship between how the teacher in a classroom perceived the usefulness of the technology and the effect it had on student engagement and achievement. Students are already fully immersed in technology outside of school, teachers need to become comfortable with and adapt their teaching styles to match the students' ability, interest, and learning style.

If a teacher has a negative pedagogical stance toward the integration of ICT, but still attempts to use it in class, it has been proven to have a negative effect on students. Academic achievement goes down, the amount of frustration and anxiety increases in class, and the number of discipline issues that a teacher must deal with increases as well (Montrieux et al., 2017). However, if a teacher has a positive pedagogical stance towards the integration of technology in class, the exact opposite occurs. Academic achievement for students increases, students feel

more engaged in class, differentiation of material becomes easier for teachers, and the number of discipline issues decreases (Nel, 2017).

Often, a negative pedagogical stance towards ICT comes from previous negative experiences with technology. The negative experiences that shape these teachers' beliefs about technology are usually associated with the first-order barriers that we have already discussed. They can also manifest in different ways as well. Some teachers believe that with the advancement in technology, they will be replaced and will no longer be needed in the classroom (Montrieux et al., 2017). This concern is untrue; ICT should be used to prepare material, support lessons, help with student engagement, and for communication purposes, not replace the teacher in a classroom (Comi et al., 2017). If students are left without the guidance of a teacher, they can easily become overwhelmed and frustrated. Although there is a proven need for teachers to properly integrate ICT, there is little research to guide teachers about proper planning and creation of lessons that appropriately implement ICT to optimize student learning. There are, however, studies that show teachers play an integral role in learning using ICT (Kollar, Wecker, Langer, & Fischer, 2011; Raes, & Schellens, 2016).

Knowledge and skill. One of the most common barriers teachers that self-identified was that they did not feel they had the appropriate knowledge or skills needed to integrate technology into the classroom. Even if teachers want to incorporate the use of ICT in their classrooms they were very apprehensive as if a problem arose they would not be able to solve the issue in a timely fashion, or at all (Al-Eidan, 2017).

The competence of teachers with the use of ICT is very important when considering the best interests of our students. Sarkar, Sundarakrishnan, & Mohapatra (2015) found that if teachers lack the proper knowledge and skills when it comes to the integration of ICT in the

classroom, it has detrimental effects on their students. The misuse of technology can be linked to a decrease in student engagement as well as academic achievement, and an increase in student discipline issues.

Montrieux, Vanderlinde, Schellens, and De Marez (2015) used the term “book behind glass” when talking about teachers who attempt to use technology in their classroom without the appropriate knowledge or skill level. Essentially, teachers are using technology in the classroom in a way that is unnecessary and occasionally counterproductive. If teachers are simply uploading worksheets, or making a classroom textbook available online, then the technology is being used inappropriately. The most common reason for this misuse is because teachers are unaware of what technology can bring to their classrooms or how to use it appropriately to enhance their teaching. Technology is meant to be used in innovative ways and to help students perform tasks that they otherwise would not be able to complete without the integration of technology. Ifenthaler and Schweinbenz (2013) found that if teachers are not equipped with the proper knowledge of how to incorporate ICT then the chance of successful integration is minimal. Even if they are open to the idea of using technology in their classrooms and have a positive pedagogical belief, they will still deliver their teaching through traditional means and students will not reap the benefits of having a technology-filled classroom. Technology should not simply replace something in the class that could otherwise be completed similarly without the use of technology (Montrieux et al., 2015). If teachers treat technology this way and have a ‘replaced-by technology’ mentality, it results in students feeling overwhelmed and frustrated (Montrieux et al., 2017). This illustrates the importance of appropriate knowledge of technology and skill in using it for successful integration in the classroom.

The constantly evolving nature of technology increases the severity of this barrier. Once teachers become comfortable implementing a technology in class, newer technologies with more features become available. With the pressures that teachers face to implement the newest and the best in their classrooms, they constantly feel behind when it comes to their knowledge of, and skills with the newest and best technologies for their classroom. This cycle naturally, leads to negative perception about the integration of ICT in their classrooms.

Workaround to First and Second-Order Barriers

A majority of the studies that dissect the first and second order barriers that hinder teachers also provide solutions to help educators have more positive experiences with the integration of ICT. These solutions range from small changes that would be seen as mere adjustments, and transformations that would require bigger shifts in thinking, and potentially remodeling different parts of the current education system.

I will focus on changes that could be implemented at two different levels: the school level, and the district level. At the school level I will consider changes that teachers can make to help integrate technology in the classroom, as well as changes that an administrative team can complete to aid teachers in this endeavour. At the district level, I will review what changes can be instituted to aid schools in their task to implement ICT positively.

Overcoming Barriers at the School Level

Teachers. Teachers are most able to overcome the second-order barrier of appropriate skill and knowledge of integration of ICT into the classroom on their own. The major way that teachers are able to overcome this barrier would be to attend various professional development sessions offered (Hew, & Brush, 2007). Targeted sessions on specific topics identified by teachers would build their confidence and comfort level with technology and would allow them

to observe the benefits of integrating ICT in their classrooms. For these sessions to be most effective for teachers, they must be appropriate for their learning needs, and allow opportunities for them to engage in active learning about the technology (Comi et al., 2017). These PD sessions need to focus on different technologies that could be implemented in the classroom, as well as basic technological knowledge. For instance, PD could cover how teachers can support themselves with issues related to technology, as well as classroom management skill in a technology-rich environment.

McKnight et al. (2017) also showed that if teachers were able to overcome the skills and knowledge barrier then the first-order issue of time would be decreased. Traditionally, teachers spend a large proportion of their time providing whole class instruction, grading papers assignments, and tests, as well as tracking progress, and locating late or missing student work. These tasks can be simplified if teachers know how to use technology appropriately, which allows teachers' time to be better spent engaging in side-by-side coaching, providing immediate feedback for students, or other tasks around the classroom that are directly linked to positive learner outcomes.

Hew and Brush (2007) suggest that a solution for the issue of the amount of available time would be for teachers to limit the subject areas in which they integrate ICT. Instead of trying to take technology and implement it into every aspect of their teaching, teachers may be more comfortable and have more positive experiences, if they choose only one or two subject areas in which to implement ICT.

A solution that Hew and Brush (2007) offer teachers to help overcome the first-order barrier of accessing support for technology issues is to use the knowledge that is already present inside of the classroom. Today's students are growing up in the age of technology and are often

very capable to assist when issues arise. Not only does this help the teacher solve technological problems that occur in a timely manner, but it also allows students to take a leadership role inside of the classroom and take more responsibility for their education.

School administrators. A school's administrative team has the potential to have the most profound effect on teachers and their implementation of ICT in the classroom. There are several first and second order barriers that administration can assist with to help teachers have a more positive feeling towards the use of technology in their everyday teaching (Garcia, & Abrego, 2014; Uluyol, & Sahin, 2016; Weng, & Tang, 2014).

The barrier that administrators need to address first is the second order barrier of a teacher's negative pedagogical belief towards the use of technology in the classroom. Having a positive attitude towards ICT is one of the biggest indicators of whether a teacher will be successful or not when trying to implement ICT in their classroom (Mumtaz, 2000). Mumtaz believes that teachers who are resisting change are not rejecting the need for it, but are not given enough opportunity to fully understand the change. For administrators to support a pedagogical shift and enable teachers to understand the need for the use of ICT in their classrooms, administrators must offer assistance. By providing opportunity for successful understanding, use, and implementation of lessons that show the proper integration of ICT, administrators will be able to support teachers effectively as they navigate this pedagogical shift as well as enable them to see the positive benefits of using technology in their classrooms (Kim et al., 2013; Montrieux et al., 2017).

Strategies that have been suggested to help promote this belief shift include observation, practice, reflection, and both internal and external support for the teacher (Montrieux et al., 2017). For instance, if a teacher can take time and observe another teacher in the school conduct

a lesson with the use of ICT and observe the positive impact that it has with students, they would then be more willing to attempt the same lesson in their own classroom (Albion, Tondeur, Forkosh-Baruch, & Peeraer, 2015, Hew, & Brush, 2007). A relationship is formed when two individuals are actively involved in the same experience. In this situation, one of the teachers would be demonstrating the proper use of ICT in a lesson and the other would be an active observer. It would be an administrator's hope that after this experience the demonstrating teacher would serve as a support for the observing teacher and would guide them through the process of actively implementing a similar lesson in their own classroom. For the observing teacher, knowing that the other teacher would also be there to support them with any issues that might arise would be reassuring. Additionally, the experience would increase the likelihood that the teacher who is learning would have a positive experience with their experimentation with ICT. To promote lasting shift in teachers' pedagogical beliefs, experiences such as the one described above cannot be singular. To promote sustained growth and positive changes in teachers' pedagogical beliefs these experiences must occur regularly and include a culture that promotes teacher collaboration (Kim et al., 2013).

The other barriers that school administrators could help alleviate are all first-order barriers that teachers need to overcome. All these first-order barriers are very important to address to ensure positive experiences with ICT in the classroom. However, these barriers must only be addressed after the second-order barriers are resolved, as if teachers do not hold positive pedagogical beliefs about the use of technology in their classrooms then the removal of these first-order barriers will not provide a positive experience for students when using ICT in the classroom.

One of the first order barriers for which administrators can help find a solution would be the knowledge and skill level of their staff about the technology that is present in their school. An administrator should be aware of the specific supports that are needed by individual teachers in the school. Sharing relevant external professional development opportunities with their staff and encouraging attendance would help increase the staffs' knowledge and skill about the use of ICT. If there are pieces of information that the entire staff would benefit from learning, then they could provide technology learning session to the staff during times where everyone is able to attend (Kafyulilo et al., 2016). Studies have shown that for these PD sessions to be most effective they must be presented at the technological level at which the individuals are comfortable, and the sessions also must incorporate built-in time for teachers to physically experiment with what they are learning (Comi et al., 2017). If teachers are not given time to experiment and ask questions it is very unlikely that they will bring what they have learned theoretically to their classrooms (Sarkar et al., 2015).

The issue of time is another first order barrier that the administrative team can help accommodate at a school level. However, administrators are unable to change the school's budget in order to allow the hiring of more teachers, and therefore reduce the amount of time that teachers need to be in front of students. What Hew and Brush (2007) suggest is that administrators create a timetable that allows time for teachers to collaborate with colleagues who have similar teaching assignments. This partnership allows for collaboration on technology integrated lesson plans and materials, as well as the formation of a small support network within the school for teachers during the time already built into their schedule.

Another barrier the administrative team at a school can impact is the lack of access to certain technologies. Depending on the school's budget and how it is allocated, the school may

be able to purchase more ICT items to get them into the classrooms (Hew, & Brush, 2007). If it's not possible to purchase more items, and schools are lacking in technology, it is better to have technological devices in a classroom rather than in a centralized location – I have no idea what you were trying to say here so I guessed (Hew, & Brush, 2007). Individual classroom access makes it easier for teachers to implement these devices and use them in lessons. If devices are sitting in central locations, it is more likely that they go unused.

Overcoming Barriers at a District Level

Central office. For many of school level solutions to come to fruition there needs to be support from the districts' central offices. There are several different ways that individuals in central office can support schools in the district, but often it will come down to the allocation of funds to each school.

A division's central office can assist both schools and teachers to increase knowledge and skills with ICT by providing meaningful and appropriate professional development (Hew, & Brush, 2007). Also, by ensuring that central office is providing suitable PD to the division's teachers, based on their current level of knowledge, central administration can help teachers feel more comfortable with the technology that is being integrated into their classrooms and help teachers have more positive experiences (Comi et al., 2017). This goal can be accomplished by ensuring that PD on ICT is happening congruently at several different skill levels. In order to make multiple sessions financially feasible, the district can invite teachers of all different knowledge and skill levels from all the schools within the district. A professional development model such as this would be beneficial to all schools in the district for several reasons. Schools would not have to spend what limited funds they have allocated for professional development on sessions that other schools are already hosting as well. Also, it would broaden the spectrum of

sessions that are available to teachers as they would be aware of all PD sessions that are occurring at any given time. If the school in which they work is not providing a session that interests or challenges them, then it is likely that another school would be offering a different session that would be more suited to that individual's time and needs.

Additionally, divisions could hire technology consultants who are available to assist schools and teachers with their ICT needs. To optimize this solution there must be enough consultants available for teachers to access their expertise in a timely manner. Also, these consultants should be spending time assisting teachers in having positive experiences with technology within their own classrooms. Not only does this help shift a teacher's negative pedagogical stance towards a positive one (Kim et al., 2013), but it ensures that while a lesson is going on there is a person who can support the teacher in the classroom if any issues arise (Hew and Brush, 2007).

Increasing the funds that are available for schools would also help decrease the barriers that are faced by teachers. Depending on how the administration decided to allocate their funds they could potentially alleviate two different first-order barriers. With larger budgets administrators would be able to allocate funds to purchase resources and make them available to teachers or increase the amount of time that teachers would have to plan and co-create appropriate lessons that involve the use of ICT in the classroom.

If a school had a larger budget, the schools' administrators would be able to spend more money towards the purchasing of more or newer technologies. This increase in ICT would help alleviate the barrier that teachers are facing about the lack of resources in schools (Al-Eidan, 2017; Hew, & Brush, 2007; Mumtaz, 2000). Teachers would be more willing and more able to

incorporate ICT in their classrooms if they knew that physical devices would be available when required.

A solution that could be seen as a quick, but unrealistic, fix to the barriers that are facing teachers would be for each school to have a larger budget. For a school to have a larger budget the provincial government would have to examine how funds are allocated and adjust budgets accordingly. Although this is a solution that is highly unlikely, it is the one that would provide the most significant results. If administrators had larger budgets to work with at a school level they would be able to eliminate several of the first order barriers that are challenging teachers. With a larger budget an administrative team would be able to purchase more physical resources for teachers to use, as well as hire more staff members. This increase in staff would lower the number of classes that each teacher would need to teach, thus providing more time for teachers to create, prepare, and implement lessons which are infused with technology (Al-Eidan, 2017; Hew, & Brush, 2007). It would also be easy to create cohorts of teachers who would be able to collaborate on these creations, and who would be able to form support groups within the school for each other when problems do arise.

Chapter 3

Project

When starting to look at different projects that could be completed around the integration of technology in the classroom I wanted to select a project that had a potential for immediate impact. I know that my current skill level and knowledge of ICT helps me see the positive impact that technology can have in a classroom. I would like to make sure that all teachers see that potential as well and do not let their past negative experiences affect how they teacher the students that they presently have.

As previously discussed, the most important factor for a positive integration of ICT into a classroom is a positive pedagogical belief about the use of technology coupled with the appropriate skills and knowledge of how to use the technology. A very powerful way to promote the shift away from a negative pedagogical stance would be to provide positive experiences with technology in a classroom setting.

This led me to create a professional development session about the integration of technology that is aimed towards school administrators. The reason that I chose to aim my session towards administrators is that is where I believe that I would have the largest range of influence. As school administrators they are tasked with being instructional leaders within their building. If I am able to arm them with the knowledge that I have gained through my research, and different ideas for how they can assist their staff members, then they would be able to go back to their buildings and provide ongoing leadership and support in hopes of shifting individuals towards, or strengthening, a positive pedagogical belief towards the integration of technology in the classroom.

When looking at the creation of a PD session, it is always important to know that there is valid and reliable research backing up what is being proposed. This is the reason that I started my

presentation with the research that I found while conducting my literature review. I wanted to arm administrators with the knowledge of why the integration of technology is important in case they were met with questions and resistance from their staff.

After discussing what research that I found on this topic, and the barriers faced by teachers who try to integrate technology into their classroom, we would move to a very hands-on portion of the presentation. I wanted to make sure that administrators would leave this presentation with tangible ways in which they could provide positive experiences to staff members who are struggling to integrate technology into their teaching practice. In my presentation I review nine different ways that teachers would be able to integrate technology into their classrooms and discuss how it could be used to positive effect teachers, students, or parents experience around the classroom.

A shift in pedagogical beliefs is not one that happens quickly. It is a process that needs to be nurtured and slowly shifted from one belief to another. My hope from this is that administrators would take these ideas back to their buildings, help staff members integrate these ideas into their classrooms, and that the individual integrating these ideas would have a positive experience with them in their classrooms. I would hope that after having a positive experience with one form of technology the teacher would start to see the positive benefits of integrating technology into their classroom and would be more open to further integration.

I have included all of the slides and talking notes that I would use for this presentation in Appendix A. To further enhance my point about the need for the integration of technology I would be completing the entire presentation using the last application that I discuss during the session, "ShowMe". It is an application that would allow me to circulate throughout the room while having discussions, but still being able to control and make notes on my presentation. It

would also allow me to show the different programs and applications that I am discussing while everyone would be able to follow along on their own iPads or tablets.

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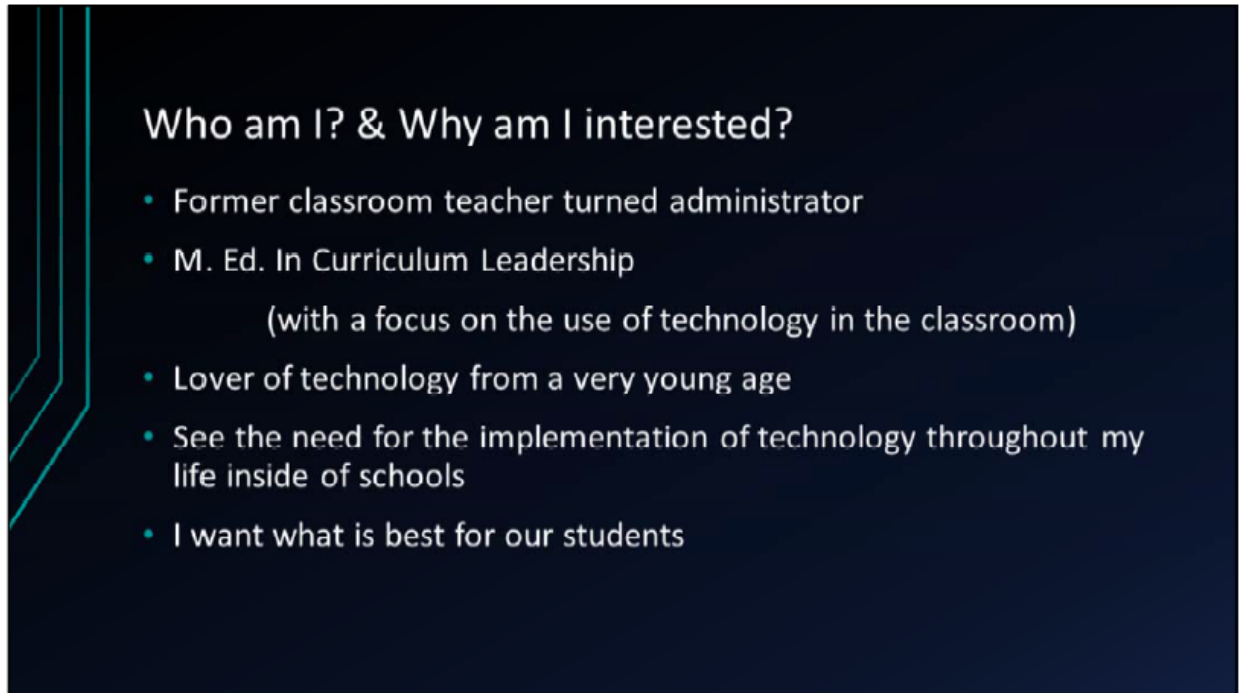
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Appendix





Who am I? & Why am I interested?

- Former classroom teacher turned administrator
- M. Ed. In Curriculum Leadership
(with a focus on the use of technology in the classroom)
- Lover of technology from a very young age
- See the need for the implementation of technology throughout my life inside of schools
- I want what is best for our students

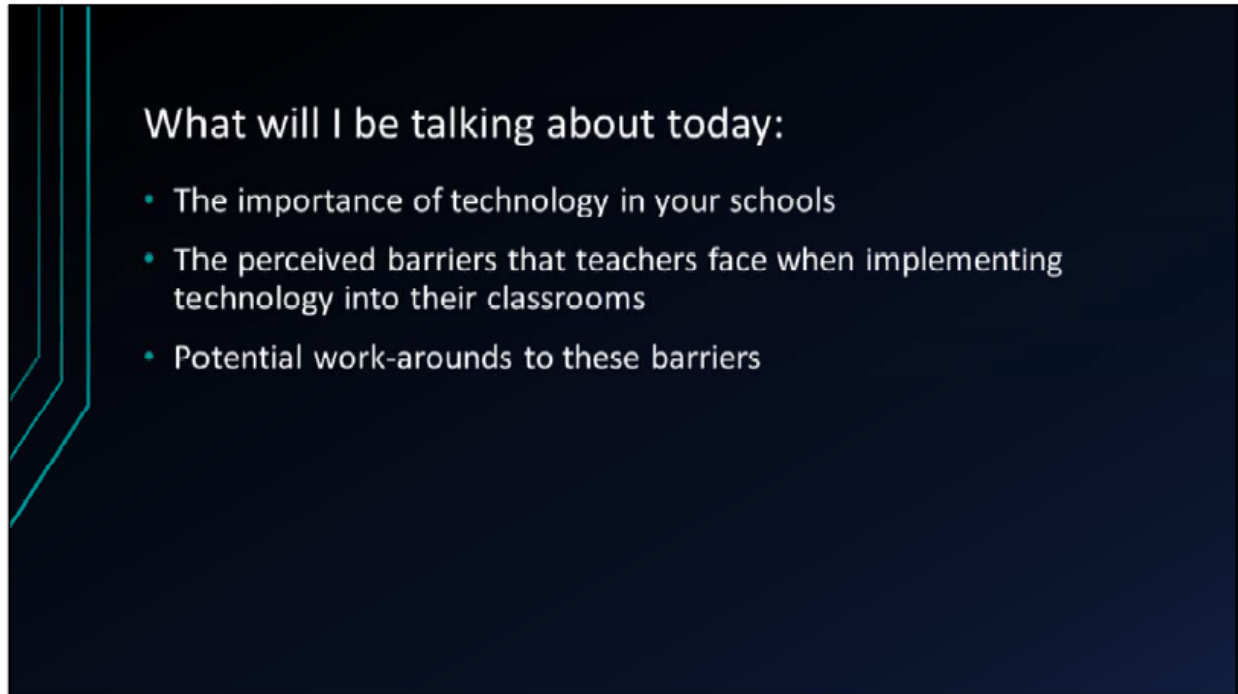
Personally, I am not a big fan of the “About Me” sections of these presentations, but the reason that I do think it is important is that it speaks about my past and where my passion for technology came from.

If we look at my professional career I have recently made the move from being a classroom teacher to an administrator. I have also recently made the jump from working in a Junior High School to an Elementary school. When I taught in Junior high I started teaching Math but was lucky enough to have another teacher as passionate as me about technology and I was able to help develop a course called Video Game Design.

My love for technology started at an early age. I was lucky enough to have two parents who noticed and supported my interest in technology. Throughout all of my schooling I took as many tech-related courses as I could, this paired with a lot of self-teaching had me sitting at a pretty high technological knowledge level.

My interest in technology in education didn't start until I was studying for my B.Ed. because I noticed that some of my fellow students struggled with the most basic technology. This worried me because at the time I believe that technology would play an integral role in the classroom. As I started teaching I noticed that outside of school students immersed themselves in technology all the time. Whether it be on a computer, with a cell phone or a tablet, students were always on some sort of device. I felt that if I really wanted to make my teaching interest my students that I would need to play on their likes. By integrating technology in my lessons, I was hoping that I would connect their interests from outside of the classroom to my lesson, and take an area where they have already experienced success and transfer it to an area where they may have experienced some struggles in the past.

Probably the most important point on this slide is that I want what is best for our students. Through the research that I have completed, if done appropriately, the integration of technology into our classrooms is what is best for our students. And I would like what is best for them!



I am not a big fan of this title (yes, I am aware that I wrote it), but I hope not to be talking for too long today. I do also want to get the technology that I am talking about into your hands for you to experience what I will be discussing throughout this presentation.

First I am going to quickly go over the research that I have found about why integrating technology into the classroom is so important.

Next, I will go through the perceived barriers that teachers have identified about implementing technology into their classrooms.

After I will discuss what you can do as an administrator to promote the use of technology in your schools, as well as how you can possibly start a pedagogical shift in those teachers who are very resistant to the acceptance of technology in their classrooms. This will be the point in the presentation where we all get to test out different ideas of how to integrate technology into the classroom. You can see the devices that I have out on all the tables. The reason that I have devices out and in front of you is because you will get a chance to test out and experience everything that I am talking about and see exactly how easy some of these suggestions are.

Why the push for technology?

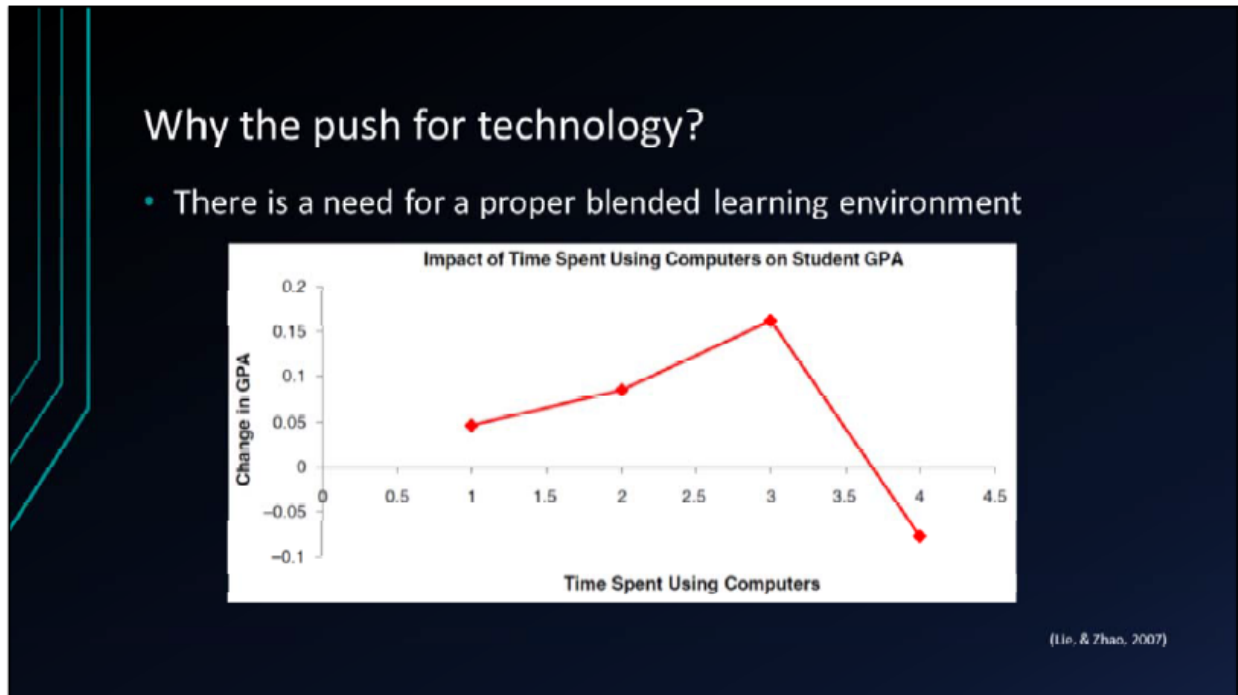
- Achievement:
 - Current studies are very conflicting. There are studies that show that technology increases student achievement*, but also studies that show either no improvement or a decrease in student achievement**
 - We need to dig deeper into these studies to understand the research
 - Teachers pedagogical stance is important
 - Teachers need to create a blended learning environment***

* (Cristol & Gimbert, 2013; Kazu & Demirkol, 2014; Olsen & Chernobilskt, 2016)
 ** (Comi, Argentin, Gul, Origo, & Paganl, 2017; Cristia, Ibararan, Cueto, Santiago, & Severin, 2017; Skryabin, Zhang, Liu, & Zhang, 2015)
 *** (Comi et al., 2017; Nel, 2017)

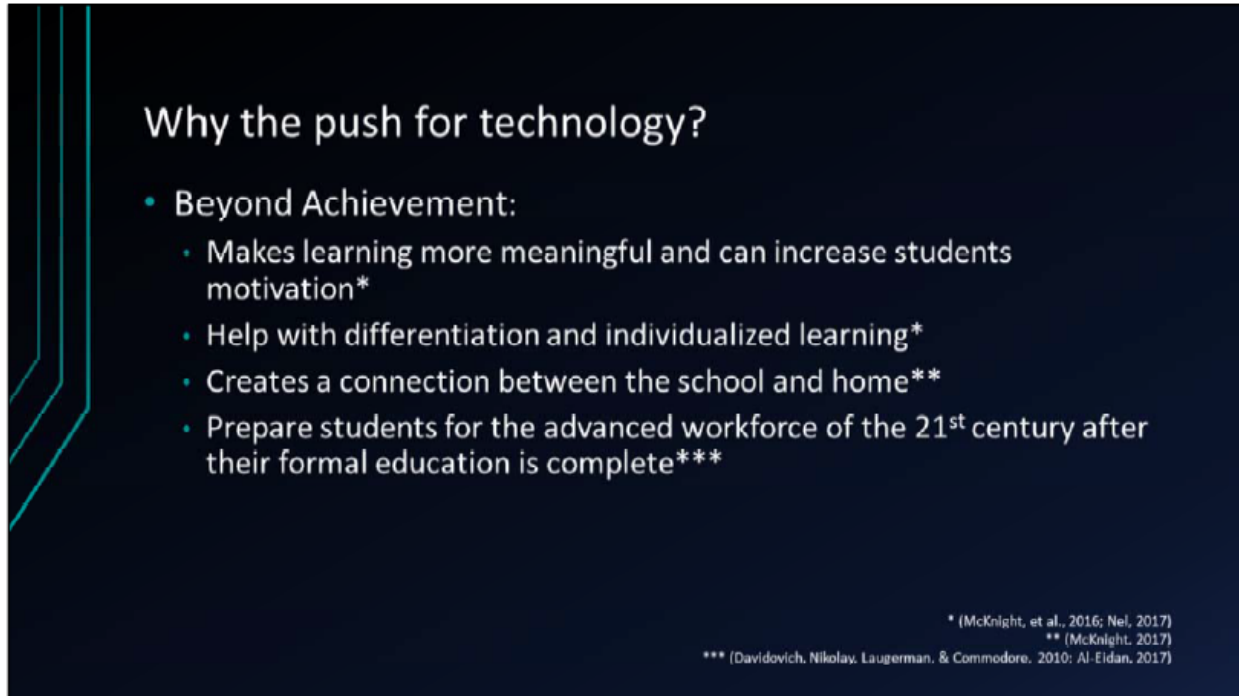
So why is there such a push to integrate technology into the classroom? Often in schools the effectiveness of an idea is judged by the direct correlation that it has on student achievement. If using technology in the classroom was worthwhile, then we should see an improvement in student achievement.

If we look at the studies that are currently out there it could be very confusing. There are studies that show technology in the classroom supports an increase of student achievement. But likewise, there are also studies out there that show the exact opposite. To make sense of these studies we need to dig deeper to understand the research that is being presented to us. If technology is just thrown into a class with a teacher with no other help or instructions it is very likely that students will actually see a decrease in achievement. Without proper support, guidance, attitudes, or beliefs technology will not be helpful in a classroom setting. But if all of the proper supports are in place for teachers, then technology can be very helpful, and yes, in fact increase student achievement.

There have been studies conducted that have found what the ideal amount of “screen time” is for students in an average day of school. As I am sure most have you already have assumed by the title of “blended learning environment”, is that there needs to be a good mix of time that students use technology in the class, and time for more “non-technological” teaching methods.



This graph shows that if students are using technology properly in the classroom it has a positive correlation with a students' GPA, to a certain point. In this graph, the turning point happens is after a student has spent 3-hours using technology. At this point, it is shown that technology actually has a negative effect on a students' GPA. This study proves that there is a need for students to be learning in a blended learning environment. In other words, a learning environment where the educator knows when it is best to be using and integrating technology into the classroom, and when it is best to rely on more "traditional" teaching means and methods.



Why the push for technology?

- Beyond Achievement:
 - Makes learning more meaningful and can increase students motivation*
 - Help with differentiation and individualized learning*
 - Creates a connection between the school and home**
 - Prepare students for the advanced workforce of the 21st century after their formal education is complete***

* (McKnight, et al., 2016; Nel, 2017)
** (McKnight, 2017)
*** (Davidovich, Nikolay, Laugerman, & Commodore, 2010; Al-Eidan, 2017)

Beyond a student's academic achievement there is also a need for the integration of technology into the classroom.

Now more than ever students are more interested and immersed in technology outside of the classroom. To increase a students' motivation to learn, and make it more meaningful for them, we need to take their interests outside of the classroom and integrate them into the classroom. By doing this not will we make the learning that is happening in the classroom more meaningful, but a students' motivation for the work that is completing in class will increase.

Teachers know that each student in their classes has individual needs. Technology can be used to help differentiate lessons and individualize learning for each student in the class. There are several ways in which technology can help aid a student in an area which they are struggling in. All without compromising the integrity of the lesson which is trying to be taught.

Technology has helped improve communication between the school, the student, and home that was previously not possible.

We need to integrate technology into the classroom to prepare for a technologically advanced workforce. Employers of the 21st century are expecting that students are going to enter the workforce with a base level of understanding of foundational technology skills.

Barriers of implementing technology:

FIRST-ORDER BARRIERS*	SECOND-ORDER BARRIERS*
<ul style="list-style-type: none"> • Barriers that are extrinsic to the teacher • Majority of the identified barriers fall under this category 	<ul style="list-style-type: none"> • Barriers that are intrinsic to the teacher • Very few self-identified second-order barriers • The most important barriers to solve for teachers

* (Frtmer, Paul, Molly, Eva, & Denise, 1999)

In a majority of the studies that I reviewed, the authors took all of the perceived barriers that teachers identified and created two separate categories, “first-order” and “second-order” barriers.

First-order barriers are extrinsic barriers that are faced by teachers such as lack of resources, minimal amounts of technical support, and the amount of time to plan and prepare for lessons. A majority of the barriers that were identified by teachers fell under this category. It was hypothesized that the “first-order” barriers were identified as a majority of the barriers that were experienced because they were not barriers that they had to self-identify. Meaning usually teachers were able to lay blame somewhere else for these issues, they were not barriers that would require accepting fault.

Whereas second-order barriers are intrinsic issues that educators face such as a teachers’ pedagogical standpoint, and a teachers’ personal knowledge of skill level with the technology that is available to them. There were very few identified “second-order” barriers in the studies that I reviewed. This was believed to be the case because teachers would need to identify that they are the reason for the barrier to exist and that this is something which most teachers are unwilling to do or are unable to be aware of. But, since these issues are so closely tied to a teachers’ core beliefs about education and teaching, these are the issues that are most important to correct for technology to successfully be integrated into the classroom.



Here are four first-order barriers that teachers indicated as major reasons why they were unable to integrate technology into their classroom

1) As seen in the table that was pulled from Carver's study, the availability of resources is the first order barrier that was indicated as the most prevalent first-order barrier. Teachers feel that their schools lack the proper number of devices needed to support the number of students that are at their school. Teachers were stated saying that with the lack of devices in their school frustration grew because they were not always able to access technology when they required it. This made lesson planning very difficult because they were unable to be sure exactly when they would have access to what was required for the lesson. Even if schools had the appropriate amount of technology teachers often struggle to get the appropriate applications or software that was desired for their specific learning/teaching purposes. All of this leads to frustration and negative experiences with the integration of technology.

2) Another barrier that was indicated was the physical institution. With school and building getting older every year, some building physically cannot house the newer technology that is coming out. In several older schools the wiring is out of date and needs to be replaced for the ideal use of technology in the school. Without the proper infrastructure students and teachers experiences with technology is never ideal, with massive amounts of downtime waiting for students to log in, or waiting for different sites, programs, or applications to load. With class and school sizes growing teaching space is at a premium. With space being allocated to the placement of students first (as it should be), areas for technology often get overlooked and placed in situations that are not ideal.

3) Time is an issue that teachers always face, or should I say lack of time. A lot of teachers feel that that integrating technology into the classroom will just increase their already busy workload.

They feel that the time that it would take to learn the new technology, plan new lessons, and prepare for their implementation would take more time than they have available. Coupled with the feeling that when they go to use the technology that issues will arise that they will not be able to fix on the spot makes teachers very reluctant to try new technologies in class.

4) The availability of support always comes up as a barrier. When an issue arises, and there most likely be a few, teacher want immediate support to fix the issue so their lesson can flow smoothly. This makes sense, but usually there isn't a person within the school that is able to always offer immediate support. Usually, a call to an IT desk is required, and then they send a technician out to fix the issue, and when this loop has finished it has potentially taken days to solve an issue. When these issues arise, teachers are forced to think on the fly and change their lesson plans to something else that does not require the use of technology. This provides very negative experiences for teachers when trying to implement technology and makes them very reluctant to use it in their classrooms in fear that something like this will happen.

Taking a closer look at the table below you can see the percentages on the far right-hand side. I just wanted to point this out to show that first-order barriers are the overwhelming majority of barriers that are indicated by teachers when asked about this. The researchers who performed these studies theorized that the reason behind the lopsided numbers were due to the fact that usually with first-order barriers you are able to lay the blame elsewhere. Whereas for second-order barriers you are indicating that it is yourself that is the root of the issue. This is something that most people are unwilling, or unable, to do.

Second-Order Barriers

KNOWLEDGE AND SKILL LEVEL

- One of the most common self-identified barriers
- Lack of knowledge and skill can lead to detrimental effects with the integration of technology*
- Technology needs to be used as more than a “book behind glass”**

*[Sarkar, Sundarakrishnan, & Mohapatra, 2015]
 **[Montrieux, Vanderlindo, Schellens, & Marez, 2015; Ifenthaler, & Schweinbenz, 2013]

We are now going to start looking at second-order barriers. I am going to break down these second-order barriers a little bit more than I did for the first order barriers because these are the barriers that are most vital to fix if we want teachers to start implementing technology into their classrooms.

An individual’s knowledge and skill level with technology was the most common, and sometimes only, second-order barrier that teachers indicated in the different research studies that I examined. The lack of skill and knowledge is a huge barrier when it comes to implementation because if you are unaware what something is capable of doing, or how to properly use it, you will have a very difficult time implementing it appropriately in your class. When looking back at student achievement, the studies that showed the implementation of technology resulted in decreased student achievement was usually due to the fact that the teachers in the studies didn’t have the appropriate skills or knowledge with the technology that they were using. Lack of knowledge and skill when attempting to integrate technology into the classroom can lead to a decrease in student achievement, a decrease in student motivation, and an increase in discipline issues.

“Book behind glass” is a term that was used in one of the studies as a way that teachers use technology if they are unaware of what it can do. What is meant by this term is that some teachers who claim that they are using technology in their class simply just put a copy of the textbook online and allow students to access it through a tablet or a computer. This is not the proper use of technology in the classroom. Using technology in a classroom should add experiences that would not be achievable if they did not have that technology present. Thus, requiring a teacher to have the proper knowledge and skills with what they are using.

Second-Order Barriers

TEACHERS' PEDAGOGICAL BELIEF

- Single most important factor when integrating technology*
- Educators attempting to use technology with a negative pedagogy leads to negative student effect**
- Negative pedagogical beliefs often come from previous negative experiences and the feeling of being replaced**

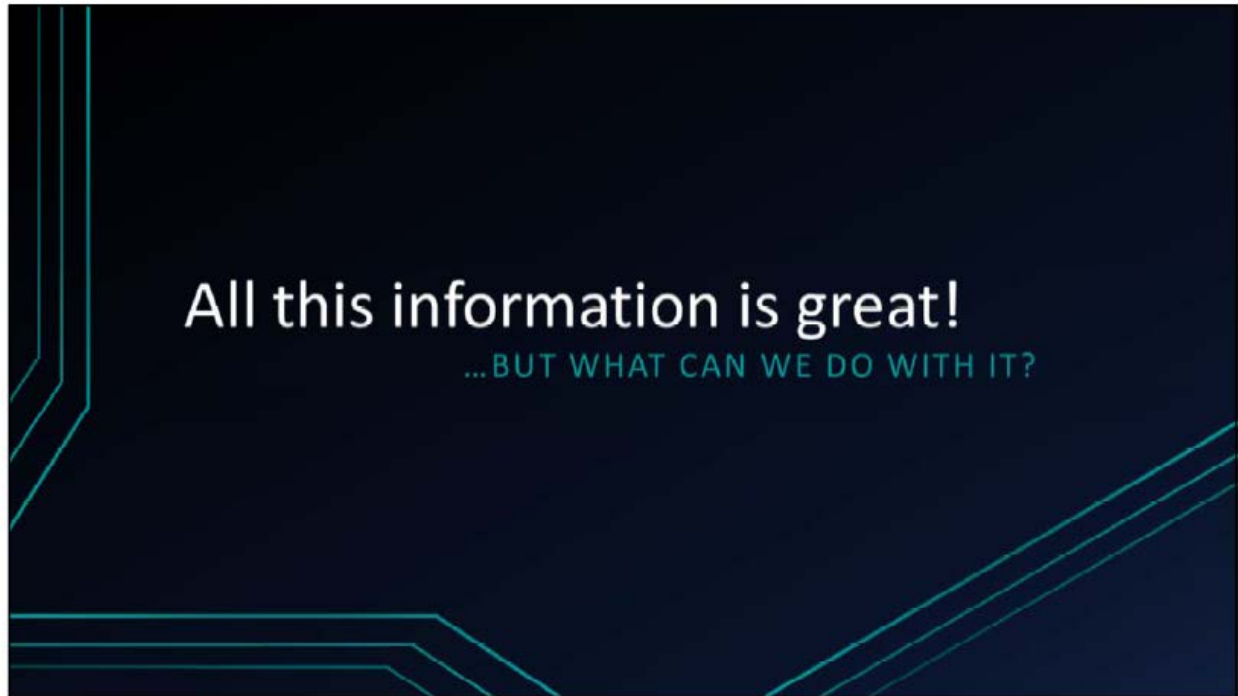
* (Comi, Argentin, Gul, Origo, & Paganì, 2017; Montrieux, Raes, & Schellens, 2017; Nel, 2017)
 ** (Montrieux et al., 2017)

A teacher's pedagogical belief, positive or negative, about the use and integration of technology into the classroom is the greatest indicator of its effectiveness. Several recent studies have proven that a teacher's pedagogical stance is the single most important factor when integrating technology into a classroom to improve student achievement and engagement.

There is a relationship between how the teacher in a classroom perceived the usefulness of the technology and the effect it had on student engagement and achievement.

If a teacher has a negative pedagogical stance toward the integration of technology but still attempts to use it in class, it has been proven to have a negative effect on students. Academic achievement goes down, the amount of frustration and anxiety increases in class, and the number of discipline issues that a teacher must deal with increases as well.

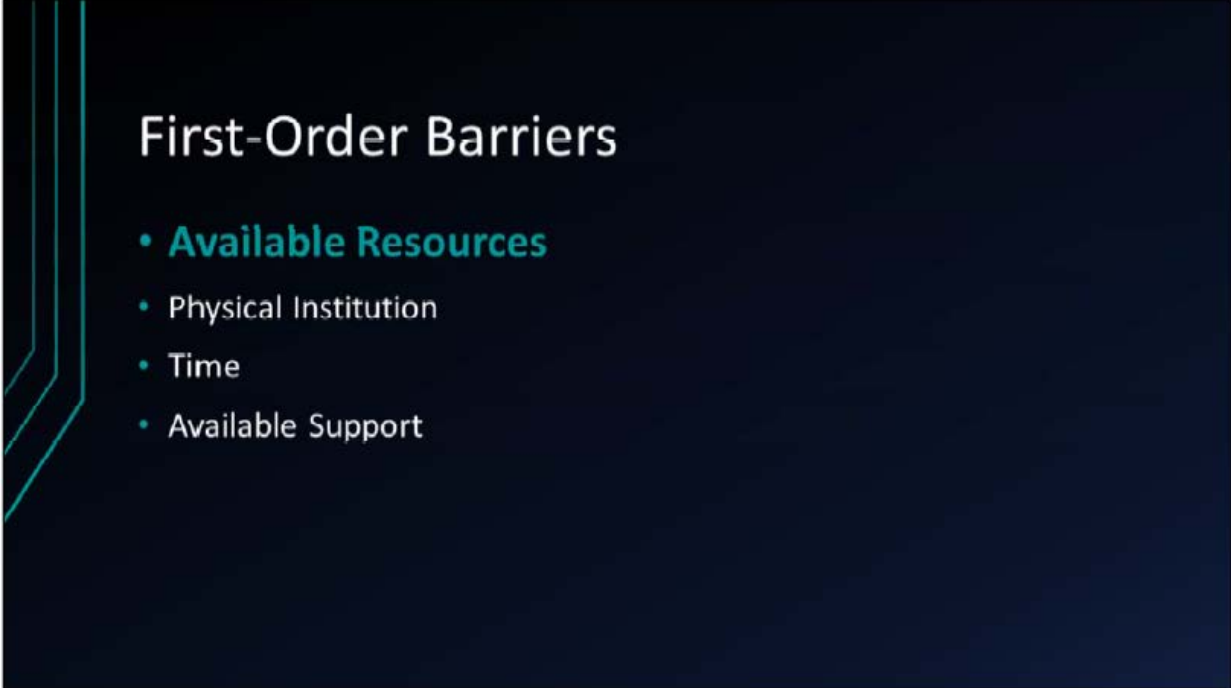
Often a negative pedagogical stance towards technology comes from previous negative experiences with technology. The negative experiences that shape these teachers' beliefs about technology are usually associated with the first-order barriers that we have already discussed. Some teachers also fear that with the advancement of technology that their job as an educator will become obsolete. This is in fact not the case; technology should be used to prepare material, support lessons, help with student engagement, and for communication purposes, not replace the teacher in a classroom.



As administrators in our schools what can we do with this information? How are we able to support the staff in our buildings to integrate technology appropriately?

As administrators in our buildings we need to make sure that we are setting up our staff for success. Making sure that they have every chance to succeed while implementing technology into their classrooms.

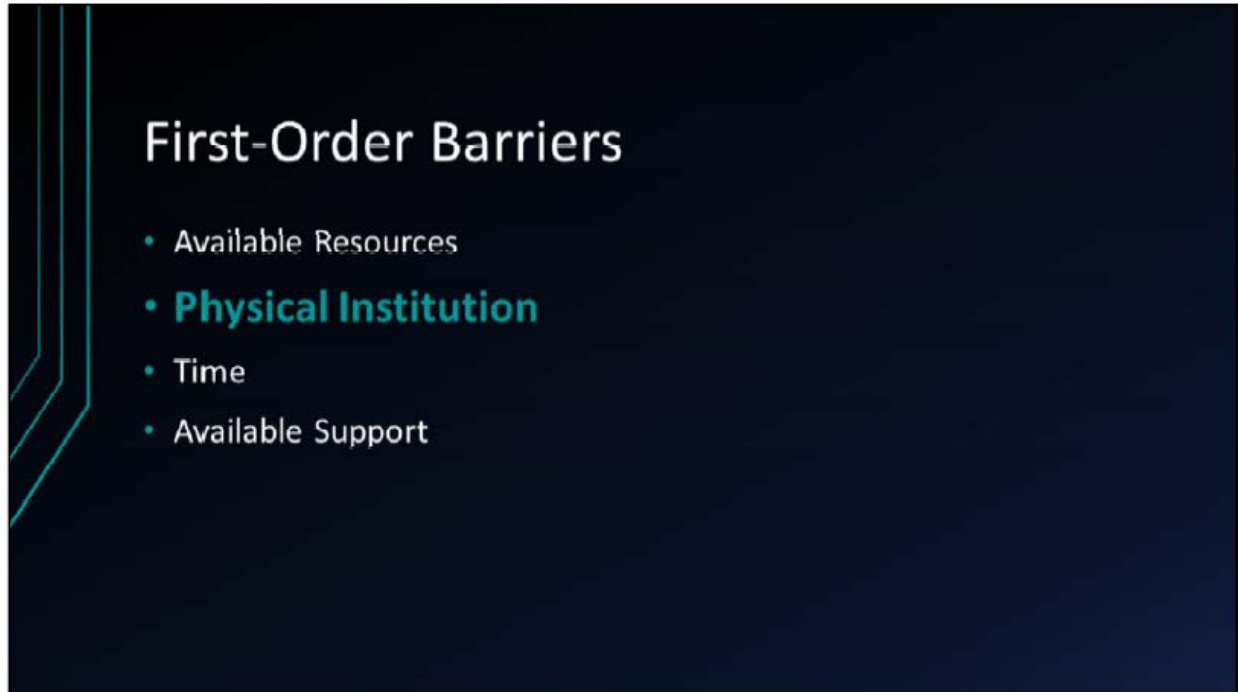
First, we are briefly going to look over the first-order barriers that we talked about earlier.



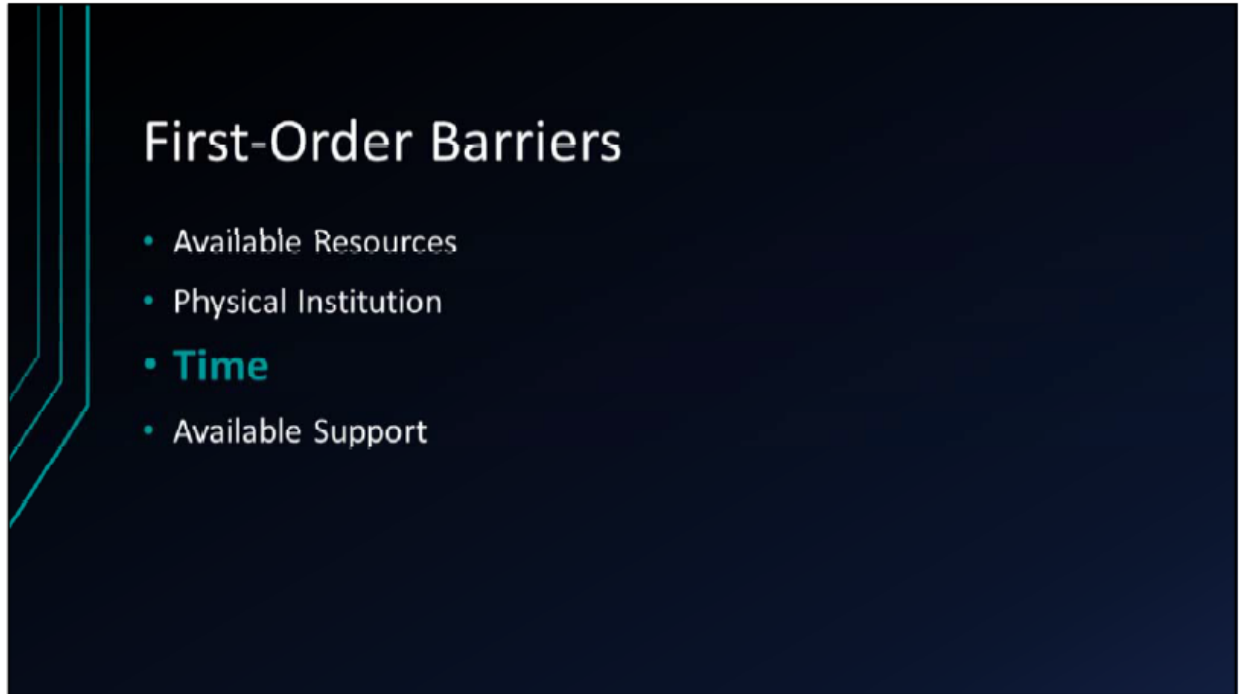
First-Order Barriers

- **Available Resources**
- Physical Institution
- Time
- Available Support

The availability of resources is a hard issue to solve. It isn't like an increase in budget will allow the purchase of mass amounts of technologies to adequately supply your teachers with everything that is needed. But what some research has shown is that the placement of technology can help provide some solution to this issue. It has been found that the integration and use of technology increase dramatically if it is placed in the teachers' rooms and NOT in a more centralized location (Hew, & Brush, 2007). If devices are sitting in central locations it is more likely that they go unused and just collect dust.



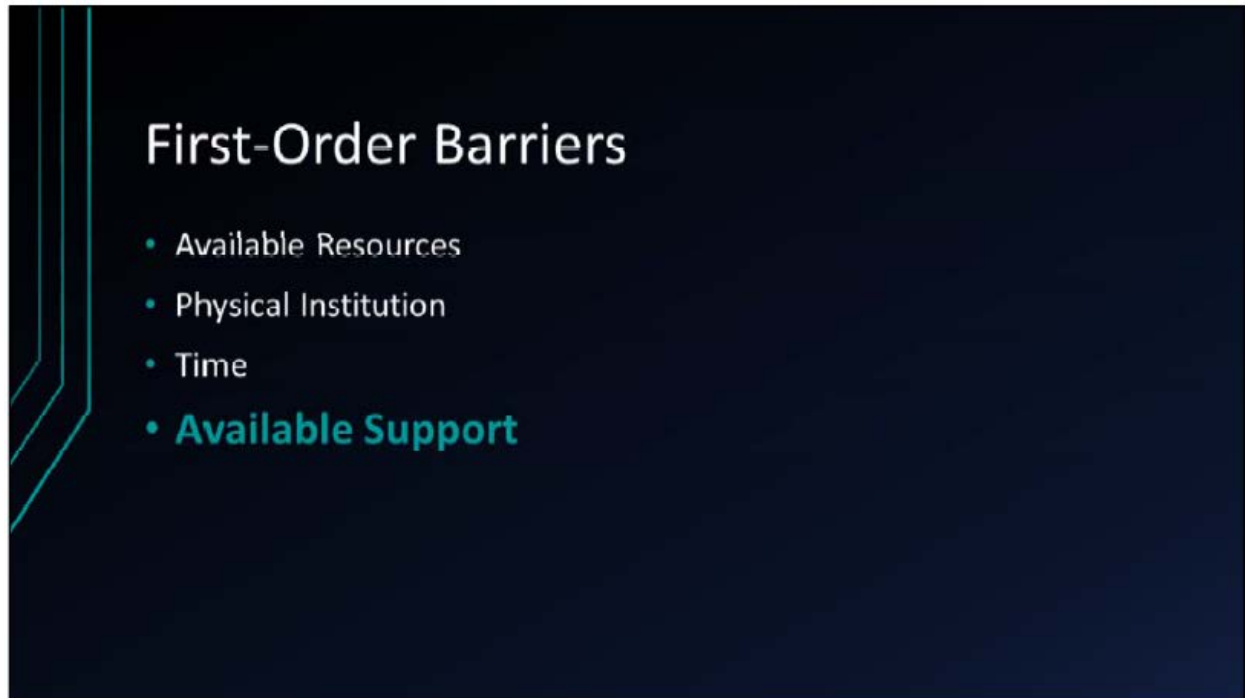
This is a very hard barrier for administrators to solve as usually it requires a lot of infrastructure work, and a lot of money, to complete. But what can be done is you can show your teachers that you support them by always advocating change to your district office (or whoever you would need to talk to for a change in the building to occur). Show your teachers that you are supporting them in trying to get a change to happen. Whether change occurs or not they will appreciate your support and know that you are fighting for them.



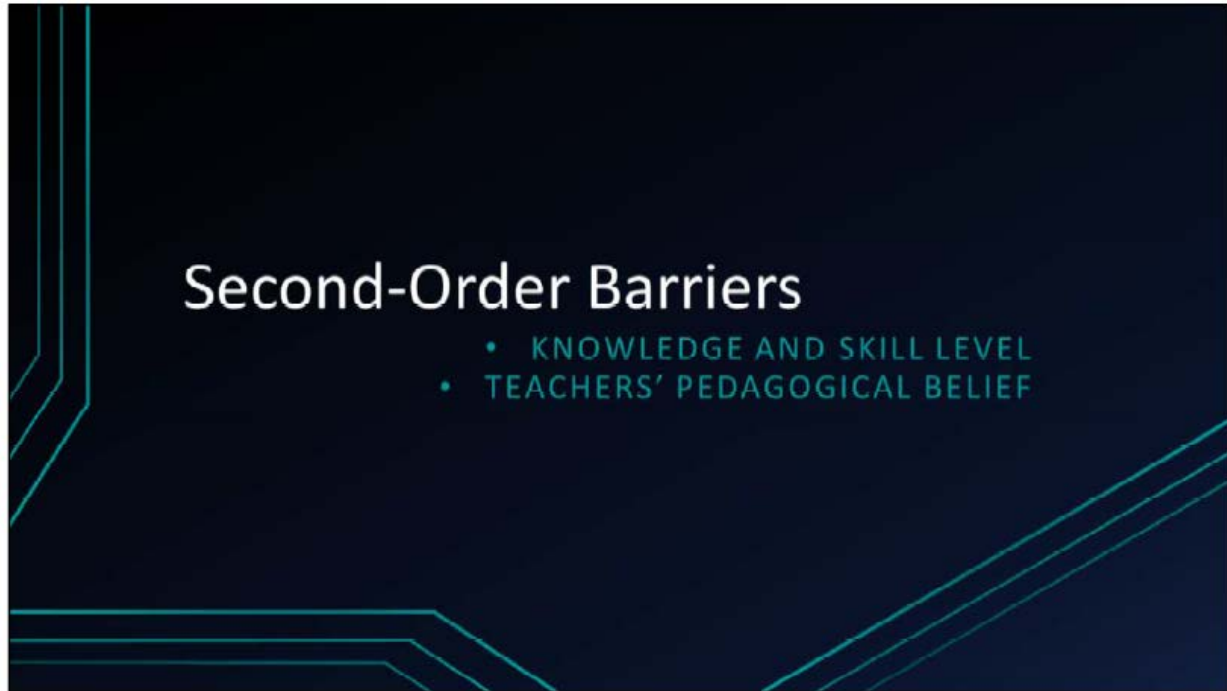
Time is a very tricky barrier to find a solution for as it is very difficult to give teachers more time to work with. But what you can do as an administrator is help teachers by making sure that the time they have is used appropriately and effectively. I am not suggesting that you micro-manage your staff members as that will not help build a positive relationship with them. But one solution would be to construct a timetable so that during their preps they are able to meet with smaller professional learning communities (PLC's) that will be able to support each other in the implementation of technology in the classroom. When making the timetable, be very cognizant of who is in each of these PLC's. Make sure that there are individuals who are very knowledgeable and have a positive pedagogical stance towards technology paired with individuals who struggle with the use of technology in the classroom.

This is also another solution for the next barrier that we are going to discuss, the availability of support.

You would hope that in these PLC's individuals who are struggling with the implementation of technology will see the positive aspects of the use of technology in the class and may attempt to use it. You are also hoping that a small support network would form between the members of these PLC's so if issues do arise they feel like there is an individual in the school who would be able to help and support them.



I have already discussed one of the ways that this barrier can be solved when I was discussing time. But another solution to the barrier would be to use the resources that you already have in your class. By resources, I mean the students. Some of the students that we have in our school are very knowledgeable when it comes to technology. We need to be able to use their expertise to our advantage. A majority of the problems that are experienced when trying to implement technology into the classroom are issues that could be solved by someone who is already in the class. Not only does this solution help resolve this barrier, but it also gives students a leadership role within the class and helps build their confidence and motivation to succeed.



Overcoming the first-order barriers that were just discussed is very important, but if we do not focus and solve the second-order barriers, even with the removal of the first order barriers, the integration of technology into the classroom will never work. Educators need to have the skills and knowledge to properly integrate technology, but also have the belief that it is what is best for their students.

These two beliefs are so closely tied with one another that it is almost impossible to talk about them separately. If teachers don't believe that the integration of technology is what is best for students, then they are unlikely to learn about how to use the technology. On the flip side, if teachers don't have the skill and knowledge to use the technology in the classrooms it is unlikely that they will have many positive experiences to have a positive pedagogical belief about the use of technology in the classroom.

Discuss the need for teachers to have positive experiences




What are we, as administrators, able to do to make sure that we promote positive technological experiences within our schools?

First you need to have a relationship with the teachers inside of your building and know where they are with their skills and knowledge about technology. You need to know they are on the spectrum of knowledge about technology. This is very important because to change individuals from a negative to a positive pedagogical stance you need to give them positive experiences where they are able to see the relevance of the use of technology in the classroom. But if you have teachers that have a minimal knowledge and skill level to begin with it is very easy to scare them off by showing them uses of technology that is at far too advanced a level for them. But you can also lose the interest of individuals who have a more advanced understanding of technology by bringing them ideas that are below their level. You need to know the needs of each of your individual staff members.

What I am hoping to do for the next part of this session is to go through different ideas, and have you actually physically test them out, of how you can promote the use of technology to these individuals so they are able to have positive experiences inside of their own classrooms. I will provide ideas for staff members that would fall into each of these categories of skill and knowledge level.

At this point I will ask everyone to take one of the iPads that is located on their tables and group up with people who are at their tables so everyone has an iPad to work with



The image shows the Remind app logo with the text "Remind → remind" and "(Available on all devices)". A blue speech bubble icon is between the words. In the top right corner, there is an orange button labeled "Minimal". Below the logo, there is a list of three bullet points describing the app's features. To the right of the text is a screenshot of the app's interface on a smartphone, showing a list of messages and user avatars. At the bottom right of the slide, there is a small text credit: "Images taken from: <http://www.remind.com>".

- Helps with two way communication between home and the classroom
- Can send messages to an entire classes, or just individual students
- Can add attachments to messages that are sent out

I will have set up a teacher remind account on the iPad that I am doing the presentation with and will have created parent accounts on each of the iPads in the audience. Like I have been doing for the entire presentation I will be mirroring my screen for everyone to see what I am doing while I am talking about this app

The first app that I would like to show everyone is the one that requires very minimal skill or knowledge level with technology. It is an application that can be accessed via computer, tablet, phone, or any device that you have, and it helps provide direct communication with all of the students/parents in your classroom. If everyone can find the remind app and open it up on your iPad we will explore this together.

Open app on my screen and show them the teacher view

As you can see I have created an account for everyone and have added you into my class. This can easily be accomplished by creating a class (**show them the button on the app to do this**) and give the parents the "class code", and when they download this app they can easily join the class.

When all of the parents/students have joined you class you can easily create messages to send to the entire group, a select group of participants, or just an individual. I will send everyone here a message so you all can see how it looks.

Create a new message to the entire group and send a quick message, they should all receive the message

Now if you would like you could respond back to me with any questions (**wait for a few people to send back a few messages and show them what it would look like on the teachers end**)

When I am creating messages, you can see that I am able to add pictures, attachments, or documents to send. This makes sending home different documents very easy, and you know that the document is not getting lost in transit.

This is a very simple application to use in class and does not require much skill or knowledge about technology. I am going to show you the next application as it is very similar to Remind, and then I will give you a few minutes to test and explore.

The image shows a presentation slide for the TalkingPoints application. At the top right, there is an orange button labeled 'Minimal'. The main title 'TalkingPoints' is followed by a right-pointing arrow and the text '(Available on all devices)'. Below the title is a list of three bullet points:

- Helps with two way communication between home and the classroom
- Message is translated into parents first language if the wish
- Parents can write messages in their first language and it translates it to English for the teacher

 To the right of the list is a diagram titled 'HOW IT WORKS' showing a flow of communication between a teacher's phone and a parent's phone, with text boxes indicating the translation process. At the bottom right of the slide, it says 'Images taken from: http://talkingpts.org'.

TalkingPoints is an application that is very similar to remind. If you can all find this application and open it up you will see that the interface looks very similar.

Open application and show them how it looks

This is an application that is used to help with communication with parents/students. The only difference in this application is that if you have parents who struggle with the English language this application will translate the message to which ever language they choose. Again, I have set up a test classroom with everyone here added. I will send out a message to everyone.

Send out a message, everyone should receive it in English

As you can see I have your settings turned to receive my messages in English. If you went to the setting bar (**direct everyone**) and selected a different language to receive the message in (**allow people time to do this**) then when I send another message to you it will not come in English.

Send another message and this time it will come in which ever language the individual selected

Everyone using this does need to be careful as we know that these translators don't always translate message with 100% accuracy. But the just of the message will get across and the message being received will be better for the parent than if it were in English. The parent is also able to write back to you in their native language and will be translated to English.

This is an amazing way to improve communication between teacher and parents who don't even speak the same language! For sure something that would never be able to be accomplished without the use of technology.

At this time, I will give everyone a few minutes to play with these applications that I just showed you. Please chat with your table groups as to how you think that you would be able to use this in your school.

Minimal

DOGOnews → **DOGOnews**
 (Best accessed via Computer or Chromebook) Current events and non-fiction literacy

- Easy was for students to research current events
- Can level complexity of article to the individual
- Easily tied to curricular outcomes
- Does have a 'Premium' account/also free to access

Images taken from: <http://www.dogonews.com>

The next thing that I am going to show you is a website that can help complete research on specific topics but allows the same article to instantly be differentiated for an individual's reading level so all students in your class are able to be completing research on the same topic at the same time. If everyone could find the internet application on their iPad and go to www.dogonews.com we will explore the site further.

When everyone has got to this site you can see that at the top of the webpage there are different sections for students that relate to different classroom subjects. But if students are looking to research something specific they can just use the "Search" function at the top of the webpage. For the ease of showing off this webpage can everyone please click the link to the first article.

If students are able they can proceed with their research and read the article, if a student requires assistance you will notice that there is a speaker button at the top. With one click the student can have the article read to them. They can complete their research by listening to the same article that everyone else is reading in class.

You will notice that several words in the article are highlighted in blue as well. These are words that have been indicated as more complicated, and some students may not know the meaning of them. If you click the blue word it will bring up a definition of the word to help with understanding and comprehension.

Instagram →  Instagram
(Available on all devices)

- Allows teachers to post pictures of what is going on in the school
- Helps connect parents to the classroom
- Can be as public or as private as you would like

Image taken from: @brentwoodeips on Instagram

The next two applications that I am going to be showing you are different forms of social media and how they can be used in the classroom.

The first app that I want everyone to take a look at is Instagram. This is an application where you are able to share photos or short videos with others. This application would be used as a way to share what is happening in your classroom and around the school with others. I see this as another way to increase the lines of communication with students and parents.

Get everyone to look on their iPad and open the Instagram app. I would have created test accounts for every iPad that would be “following” my account

When you first open the app you can see all of the photos that have been posted recently by the people that you follow. I have recently posted a photo, so at the top of this feed you should be able to see the photo that I have posted with the caption that I created for it. You can see that I have added “#”s at the end with different words behind the hashtag. This is a way to tag your photo and let other people find your photos if they are searching for your hashtag. When students or parents see your photos they have the ability to like the photo or leave comments.

Can everyone now take a photo on your iPad and post it to your test account?

I would go through how to create a post on my iPad while everyone else can follow on their own iPad posting a photo on their test account

Instagram can be as public or as private as you would like it to be. You can keep it totally open to the public. Or if you wish, like the accounts that I created, you can make it so anyone who wished to follow you and see your photos needs to ask you for permission before doing so.

Next, I will quickly look at twitter before give you a few minutes to try out these apps on your own.

Twitter →
(Available on all devices)

Minimal to Moderate

- Help communicate important information to students and parents
- Can promote what is happening in the classroom with pictures
- Can connect your learning to the real world
- A different way to have classroom discussions

Image taken from: @BrentwoodEIPS on Twitter

As you can see the skill and knowledge level is changing. Twitter is a program that could require minimal knowledge to use in your class, but if used to its extent it would bump up into the moderate skill and knowledge range.

If you open the Twitter application you will see all of the posts from people that you follow on your Twitter account. I have created test accounts for each of the iPads that you are using. On those test account I have you following me, a few random educational twitter accounts, as well as each other. Take a quick look and scroll through the post that you can see.

You can see that twitter can be used a few different ways: to post updates about what is happening (with or without photos), to post opinion posts, or even to have conversations.

Go through how to 'tweet' using a twitter account, and explain that the #'s mean the exact same thing here as they do on Instagram

If teachers would like you could use this app the same way that you could use Instagram, as a way to update parents, post photos, and connect with home.

But there are several other ways that you could use twitter, and this is why the skill and knowledge level becomes moderate.

With parental permission you could get your entire class on twitter and use it as an educational tool. You can use it as a way for students to connect with experts in whatever field you are currently studying and ask them questions by tweeting directly at them.

Guide the audience to search up anyone they would like, and show them how easy it is to tweet at someone and explain that if they reply you can start a conversation between you and them

You could also post questions and proceed it with a specific hashtag and get your students to answer the question using the same hashtag. When they have finished answering the question they can search the hashtag and respond to another classmates' post.

Post a simple question '*What was your favorite subject in school and why? #EdTalk*'. Show everyone how to search up the questions and then post their own response. Once everyone has posted their answer I will show them how to search using the hashtag EdTalk, and get everyone to find someone else response and post a rely to it

These are just a few ways that you can use twitter in your classroom. It can span from a very simple application to post updates, to an application that can expand on what is being taught in class, or even to have classroom discussions.

I have just gone over a lot of information for the last two applications, take a few minutes to explore either of them and talk with the members at your table as to how you could see these applications could be implemented in your school.

Kahoot! → Kahoot!
(Available on all devices)

Minimal to Moderate

- Fun way to retrieve immediate formative feedback
- Multiple “Game” modes
- Create a new “Kahoot” from scratch
- Search the millions of pre-existing “Kahoots” that already exist

Image taken from: <https://kahoot.it/>

Kahoot is a web-based quiz application that gives both the student, as well as the teacher, immediate feedback. There are several different types of “Kahoots”, or quizzes, that students can engage in. From your basic multiple-choice quiz, to a place in the correct order type game. Kahoot’s can also be used to lead discussions as well as ask survey questions.

When you log onto the main Kahoot webpage (have all of the iPads pre-logged in under tester accounts) you can immediately start searching for different Kahoots that have already been made by others. Beware that you should always test out the Kahoots before to make sure that everything is appropriate or working correctly. If you would like to make sure that everything is to your liking you can also just create your own Kahoots, but this does take a little bit of time.

Allow people a few minutes to search through Kahoots to see the range of quizzes that have already been created

I have created a very small Kahoot for us to do right now so you can see what it is like to be on the other end. If you can go to <https://kahoot.it/> you will be able to join this quiz and I will show you what it is all about.

As my screen is being mirrored, I can show them how a teachers’ would start a kahoot. It will get to the screen where it gives everyone the code to enter my quiz, I will wait here until everyone has entered the quiz. Once everyone is in the quiz I will show them what the teacher end of this application looks like as they are working through the very show quiz. At the end I will show how it gives everyone immediate feedback and the positives of this application

As you can see there are many positives from this application and it can easily be implemented in the classroom. If a teacher simply wants to use premade Kahoots it does not require much skill of knowledge. But when individuals want to start creating their own it adds a little bit of a greater difficulty level.



The image is a presentation slide for ClassDojo. At the top left, it says "ClassDojo →" with a note "(Best accessed via Computer, Chromebook, or iPad)". To the right is a logo featuring a green cartoon character with a black headband and the word "ClassDojo". In the top right corner, there is a purple button labeled "Moderate". Below the logo, there is a bulleted list of three points: "Create a positive culture in your classroom", "Lets students showcase and share their work", and "Share moments with parents and for open lines of communication". To the right of the list is a screenshot of the ClassDojo web interface, showing a grid of colorful avatars representing students. At the bottom right, there is a small text credit: "Image taken from: http://www.classdojo.com".

I will have created a fake class and added all of the tester accounts that I have loaded onto each of the iPads as “Co-teachers” in this application

If you open up the next application “ClassDojo” I will start discussing it when everyone can see our “class”.

ClassDojo is an application that has a lot of different uses all in one place. This is an application that I would use usually in an elementary school. The very first step for a teacher would be to create a class and have all of your students add themselves into your class and have their parent’s link themselves to their child using your class code. As you can see, just through my description this is why this application takes at least a moderate level of skill and knowledge about technology.

Once you have all of your students added into the class you can see that it can be used as a positive reinforcement tool. You can give students points for positive reasons in class, but you are also able to take away points for certain reasons as well. As a parent you are able to see if the teacher has given or take away points for your child.

Ask everyone to choose a few students and give them a few points for different reasons, and take away a point from a child just to see how to do it

There is also a messaging system much like Remind built into ClassDojo. You can message the entire class, or certain individuals, and send documents to them as well.

ClassDojo also has the ability to create groups of students for different projects (and use the same point system for the group), create seating plans, and connect to other classrooms in your school.

You can take the next few minutes and explore ClassDojo and see all of the different feature. If you have any questions please feel free to ask. While you are looking at the different features please feel free to add, take away, or do anything that you would like to the class that I have created.

Give everyone a few minutes to explore ClassDojo and ask any questions if they have them

Google Classroom →
(Best accessed via Computer, Chromebook, or iPad)

- Create paper free classrooms
- Surveys, projects, assignments, assessments, grades, all in one place
- Open up classrooms for parents to know what is going on at all times

Classroom

Advanced

Image taken from: <https://classroom.google.com>

Google Classroom is a way that teachers would be able to create an almost paperless class. This is an application that I would only use in either Junior or Senior High School. There would be certain time which you would be able to use it Elementary school, but you would need to be careful.

Guide everyone to the Google Classroom app on the iPad and into the classroom that I have set up

Google classroom is a way that teachers are able to connect with students through a forum post type way. Students are able to use these posts and comment on them and ask questions if they need.

Post a comment on the forum and let everyone see how it will immediately pop up on their Google Classroom page as well

You are also able to post assignments on Google Classroom, create deadlines for the assignments, and allow students to submit them whenever they would like. When students submit assignments, it shows the teacher exactly when the assignment was submitted so they can determine it is was late or on time. As a teacher you are able to provide feedback for the students and then give them back their assignments all online.

There are a lot of different features that can be used to make a classroom run smoothly and efficiently. There are several PD session, or online courses that can be taken that go into much more detail then I will here. I will give everyone some time to explore Google Classroom and ask any questions that they may have.

Allow table to explore and discuss that uses of Google Classroom

ShowMe →
(iPad/Tablet App)

Show Me

Advanced

- Creates an interactive whiteboard with a tablet that mirrors to a SmartBOARD
- Can quickly share students work for entire class to see easily
- Everyone can access and interact with the whiteboard through the use of a tablet

THEOREM:
2 // PLANES CUT BY A 3rd PLANE → LINES ARE // (INTERSECTION)

Image taken from: <https://www.showme.com>

The last application that I am going to show you is the “ShowMe” application for your tablet. I won’t be discussing it too much because you have seen this application in action this whole presentation. It is the application that I am using currently. It is allowing me to control this presentation, write notes on the presentation, and flip through different application, all while I am walking through the crowd talking to everyone. This application allows teachers the freedom to move around the classroom while still using all of these technological applications.

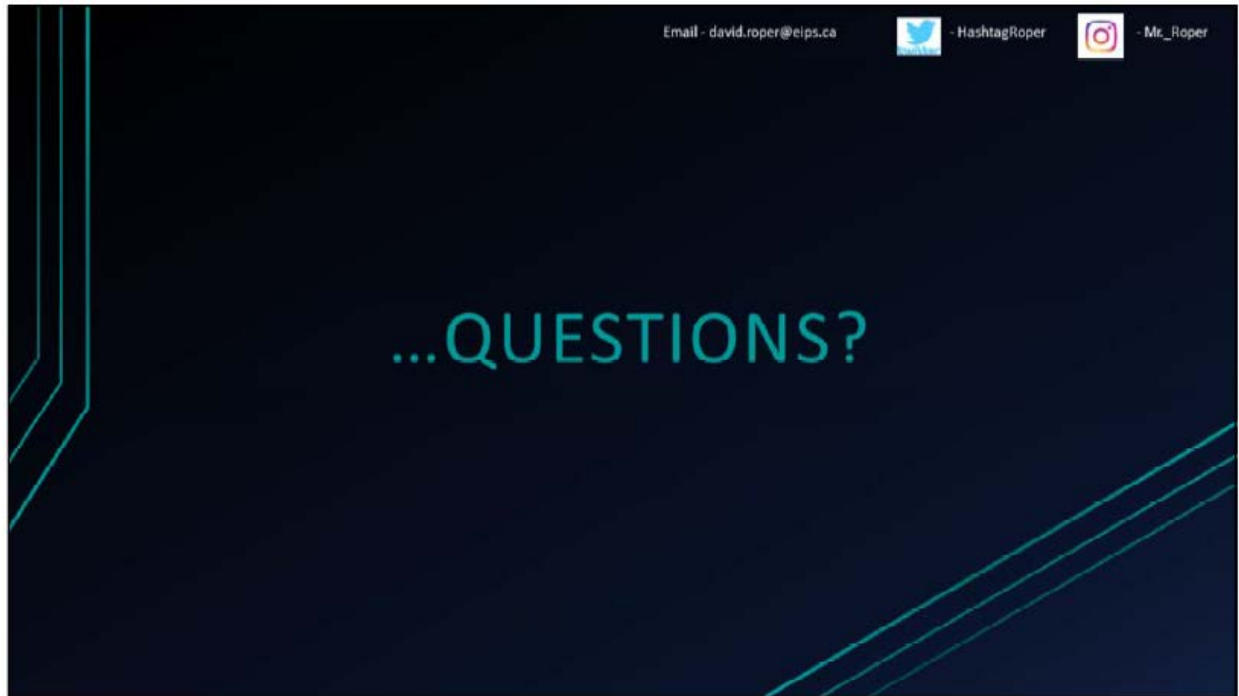
You can use the ShowMe app as an interactive whiteboard as well. You can take photos of students work as they are completing it and share it easily with the rest of the class.

Take a photo of an individual’s ‘work’ in the crowd and bring it up on the projector

You are able to make marks on the work if you would like, or simply delete it once you are done using it. After you presentations, much like what I am going to do. You can save your presentation, with all of the mark ups and notes that you have made on it and send it out to any individual that you would like. Making the slides that you present more meaningful to your class, or potentially the staff meeting agendas more meaningful to your staff members.

I have added this application on your iPads, but you obviously won’t be able to connect to the project like I have, but you are still able to see how the application work and discuss ways that you could see it being used in your school. Again, this application is a little bit more technical and would require a teacher to have an advance level of skill and knowledge with technology to use this effectively in their classrooms.

Allow teachers some time to look at this app, or any other of the applications that you have shown them and ask any questions that they may have



Thank you very much for coming to this presentation. I hope that you have found it very informative and I hope that you have found some ways that you could attempt to change some of the negative perceptions of technology to positive ones. For some individuals it will be a very slow transition, but I do believe that it is possible for all teachers to implement some level of technology into their classes.

If you have any questions about my presentation please feel free to come up and ask me any questions that you may have. I always love discussing anything and everything technology.

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