Framing the Issue: Supporting Teachers In Technology Integration
ETEC 533
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Describing the Issue

I have identified lack of teacher comfort integrating technology as an important issue in real-life, authentic STEM education. Teacher discomfort with technology integration into STEM classes and beyond proves problematic as many teachers believe they lack the skills and experience needed to implement technology into their lessons. Other teachers believe they have the skills but struggle with how to effectively integrate technology into the curriculum. From my discussions over the years with colleagues, my role supporting teachers with technology integration, recent teacher interviews and observing a number of videos from Module A, a common theme that arose is teachers' discomfort integrating technology and their desire for more support to do so. While lack of actual technology in schools continues to be a worthy concern, I wish to focus my efforts on exploring ways we can support teachers' use of technology into STEM classrooms. I would specifically like to investigate professional development, collaboration, and mentorship opportunities that may address teachers' anxiety ("I'm not tech savvy") around using technology meaningfully in their classrooms. This issue is important for STEM educators as the new ADST (Applied Design, Skills, and Technologies) curriculum is intended to be applied to and across all curricular areas.

The resources I selected were found using CiteULike, Google Scholar, and the UBC Library database. Using the skills I developed in ETEC 500, I applied keywords to narrow the search to articles that were recent, relevant, and peer reviewed. Articles were selected from the results that addressed supporting teachers using technology in their classrooms and technology integration. I excluded articles that did not focus on teacher professional development, were not primary sources, or were not STEM related.

Annotated Bibliography

Article 1
Ertmer, P., Ottenbreit-Leftwich, A.T., Sadik,O., Sandurur, E., Sendurur, P. (2012).
   Teacher Beliefs and Technology Integration Practices: A critical relationship.
   Computers & Education, 59(2), 423-435.

This study sought answers to the following research questions:
   a) How do the pedagogical beliefs and classrooms technology practices of teachers, recognized for their technology uses, align?
   b) To what extent do external, or first-order, barriers (support/resources) constrain teachers' integration efforts, leading to potential misalignment between beliefs and practices?

   These two research questions relate directly to my issue because they address the very important concern that lack of support/resources or perceived lack of support does play a role in the implementation of technology use in the classroom.

This study used a multiple case-study research design to investigate the practices and pedagogical beliefs of twelve award-winning K-12 classroom teachers. Data was collected from the websites of these teachers and follow-up one-on-one interviews. Websites were examined to provide evidence of the classroom practices of these teachers and one-on-one interviews looked at the extent that their beliefs supported these practices.   The websites were analyzed using the criteria of student centeredness and provided triangulation data to support alignments between beliefs and described practices.

Barriers to Technology Integration: Teachers had to rate various barriers that impacted their students' use of technology. Even though these were all award winning teachers, they still experienced barriers. These teachers found that external barriers were more impactful than internal barriers. The most impactful barriers were attitudes and beliefs (of other teachers), technology support, state standards, money, technology access and time. The least impactful barriers were internal in nature: attitudes and beliefs (their own), institution (parents), and knowledge and skills (their own). The biggest barrier to technology integration in their schools, according to these teachers, was the internal qualities of characteristics of other teachers, such as their attitudes and beliefs, or knowledge and skills.

The authors found the results of this study interesting because these beliefs were coming from award-winning teachers whom regularly utilized technology in their classrooms. Not only did they see their attitudes around technology as *not* a barrier, they actually saw them as facilitative factors. Their attitudes served to push their learning. These teachers rated internal factors (inner drive and personal beliefs) as the most influential. The authors suggest that the "best way to bring more teachers on-board is not by eliminating more first-order barriers, but by increasing knowledge and skills, which in turn have the potential to change attitudes and beliefs". The authors realize the small number of participants in this study and that the results are not generalizable. Also, the selection of teachers who were already using technology was purposely done, so more research would be needed with teachers utilizing technology at different levels. The authors believe that the results of this study have the potential to inform teaching practices, especially related to professional development.

Article 2
Kopcha, T.J. (2012). Teachers' perceptions of the barriers to technology integration and practices with technology under situated professional development. *Computers & Education,* 59(4).

Previous studies have found that short-term stand-alone professional development does not have lasting effects in technology integration (Mouza, 2009). When teachers return back to their schools they face a number of barriers to the implementation of this new knowledge; barriers such as access, vision, beliefs, time, and professional development. The purpose of this current study was to examine these common barriers to technology integration under a sustained and situated professional development in an elementary school. It was guided by the following questions:

a) How do teachers perceive the common barriers to technology integration after engaging in a program of situated professional development over a two-year period?
b) How do those perceptions change as teachers' professional development transitions from full-time mentory to teacher-led communities of practice?
c) What were teachers' instructional practices under teacher-led communities of practice and how do they relate to their perceptions of the barriers?

Participants were 18 teachers at an elementary school. These teachers, prior to this study, had little instructional technology available or professional development on using technology for instruction. Each teacher was given a computer with a document camera and projector. The school was provided with a lab with an interactive whiteboard and 32 new computers, 5 mobile cards with 15 laptops/car, online computer-based instructions available to all students, and district support three days a week. The school also hired a mentor (30 hours/week) to conduct professional development activities over the school year to provide teachers with skills/knowledge to integrate technology into their classrooms over the long-term. This mentor had prior experience as an elementary school teacher and in training teachers to use technology for instruction. The goal of the mentor was to help transition teachers to their own communities of practice in order to continue technology integration over time - after the mentor had left. The study was a single case study using multiple methods and data was obtained from observations, surveys and interviews. The follow-up also continued a year after the mentor left.

This study offers insight into teachers' perceptions of the barriers. They found that the mentor plays a role in promoting positive beliefs about technology. Results showed that teachers felt supported and helped to improve their beliefs in their ability to plan and implement technology-integrated lessons. Teachers' perceptions of lack of time were consistently negative, even when afforded with access to technology and training. The researchers believed that this was due to the time it takes to plan, teach, and manage the integration of technology - which was new to the teachers.

A year after the mentorship teachers were found to be utilizing technology in a number of student-centered ways to support learning and using desirable practices and routines. The did find that the communities of practice declined over the second year. Teachers reported that it was more difficult to integrate technology or find the time to locate and share resources without the mentor. Teachers also reported that there were more problems with technology issues.
This study was interesting because it demonstrated that with support teachers can become more comfortable with technology, but once that support is removed, many will struggle again.

Administrators and other decision makers should attempt to offer in-classroom training, mentorship, and follow-up support to assist teachers as they integrate technology. Communities of practice are most cost-effective than mentors, but this study demonstrated that they may not be as beneficial in the long run.

The researchers feel that, "additional research is needed to determine the extent to which mentoring, communities of practice, and teacher beliefs play a role in creating an environment that promotes technology integration and, ultimately, teacher's instructional practice".

Article 3
Wachira, P. & Keengwe, J. (2011). Technology Integration Barriers: Urban School Mathematics Teachers Perspectives. *Journal of Science Education and Technology,* 20(1), 17-25.

This study examined the discrepancy between the improvement in access to technology and the challenges to effectively integrate this technology into their classrooms. The use of technology has been found to be effective in growing students' understanding of mathematics content (Crader, McNabb, & Freeman, 2002) previous research has found that few teachers are integrating technology into their teaching to enhance student learning (Cuban, 2001). The researchers of this study wanted to explore the barriers that prevent technology integration in mathematics classrooms.

The following questions guided the study:

a) What are some of the technologies that are available for teaching mathematics?
b) What are the primary reasons as to why technology is not widely used in the teaching of mathematics?
c) What are the major reasons as to why teachers do not use technology in their classrooms?

The study used a mixed methodology format combining qualitative (teacher's written responses to interview questions and class discussions) and quantitative (responses to surveys to assess their beliefs and attitudes about mathematics and technology) to investigate these barriers. The sample consisted of 20 teachers who were part of a "Teaching mathematics with technology" cohort at a large university in the United States.

The results showed several barriers, both internal and external, that were preventing teachers from integrating technology:

a) Unavailability and unreliability of technology
b) Lack of technology support and technology leadership
c) Anxiety and lack of confidence in using technology

Externally, teachers felt that the availability of technology had improved, but it was still not adequate to meet the needs in their schools. Lack of hardware and appropriate software were specifically noted. Teachers also noted a wide disparity of technology within their school district; some schools had a lot and

other very little. Unreliability of technology also was a concern; either the devices were not working or teachers were scared that they would fail mid-lesson. Finally, lack of technical support and tech leadership. When the unreliable computers failed, there was not one there to help fix the problem. Internally, teachers cited lack of time to invest in learning all the types of technology or to develop lessons and activities. Teachers lack of knowledge was also mentioned. Teachers felt that they lacked the skills and knowledge to use technology appropriately in their math classrooms. A positive result that researcher noted from this study is that teachers reported that they enjoyed learning about technology (92%) and a willingness to learn how to use it more effectively. These teachers overwhelming agreed the technology is beneficial for their students (92%) and in mathematics specifically (77%).

How do we take this enthusiasm and willingness to learn and and make it happen in classrooms? The additional funding is one step, but equipping teachers with the skills to problem-solve technology issues, and professional development that is ongoing also needs to be addressed.

Conclusion: Analysing the Issue

From my review of the literature it is clear that there has existed, and continues to exist a number of barriers that educators face to integrating technology into their classes. Through this review I came to understand that these barriers are much more complex than time, resources, and professional development. Internal and external barriers play roles to varying degrees and are dependent on a number of factors including the personal attributes of the teacher.

Frustration still remains with lack of physical technology to meet the goals of the new curriculum and best practice. Creative fund sourcing through local, provincial and federal grants, private grants, parent groups and technology associations are great place to start looking to fill the void. Community non-profit organizations that rebuild/fix computers are other areas to source. Even with access to technology, educators own attitudes and beliefs surrounding technology, much of it stemming from prior experiences (or lack thereof) hamper its effective use in many classrooms. From my review of the literature, meaningful and timely professional development and mentorship are all ways to address this issue in education.

My wish is for researchers to continue to study which methods of professional development engage and support educators. Not every educator is able to take a program such as MET; nor can every educator be paired with a mentor. I am curious if Learning Management Systems (LMS) I have been studying in ETEC 565A may prove helpful in filling the professional development void that appears to still exist. A LMS that utilizes the SECTIONS model (Bates, 2014) and addresses the limitations that some current professional development contains, for example cost and time.

It is my hope that identifying best practices for educators to help transition teachers into comfort with the new curriculum, specifically the inclusion of technology in STEM related areas. Student engagement and achievement are the goal and with increased teacher confidence implementing technology in their classrooms and best pedagogical practice, educators will not only increase their confidence and skillset, but those of their students as well. I also need to consider what role I, as an administrator, can play in the development of teacher confidence and use of technology in STEM classrooms and beyond.

References

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