ABSTRACT

Case Studies of Teachers Participating in Differentiated Professional Development for the Purpose of Student-Centered Technology Integration

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School districts are quickly adopting various technologies in hopes that students can be taught in the same way their technological world works. Common reasons given to justify these expensive purchases include increasing student motivation and appealing to the "digital native." Teachers, however, tend to use technology in more of a teacher assistive role, which includes daily tasks like taking attendance or creating a worksheet. If teachers used more student-centered technology, students would have opportunities to use technology to explore for knowledge, expand their understanding of a topic based on interest, differentiate their own learning by allowing them to spend more time in areas they may not understand, and move along when the topic has been mastered. Students would also have opportunities to create and present their newly found understanding of a topic to the teacher, class, community or other interested individuals.

Numerous barriers affect whether a teacher will use technology in roles that are more than just teacher assistive. These barriers differ for each teacher and, therefore, cannot necessarily be overcome by the typical professional development opportunities

that currently exist in schools. Typical professional development most often model technology as teacher assistive. PowerPoint presentations or a speaker sharing an idea while an audience passively sits and listens has not been successful, or student-centered technology use would be rampant in schools.

This study utilized a differentiated professional development model to try to impact student-centered technology use in classrooms of participating teachers. A differentiated model provides training based on teacher need, interest, and ability. The professional development plans were written by the teacher and trainer and then implemented together throughout the study.

Utilizing a case study methodology, this study follows three teachers as they participate in the differentiated professional development model. Each case study was written to explain each teacher's progress through his or her entire experience. Each individual case was analyzed to search for themes that emerged from the data. Finally, all three cases were analyzed together to look for overall themes and findings that might have implications for professional development and/or technology integration.

Case Studies of Teachers Participating in Differentiated Professional Development for the Purpose of Student-Centered Technology Integration

by

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A Dissertation

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CHAPTER ONE

Introduction

Professional developers and instructional technologists have searched for effective ways to encourage the student-centered integration of technology into classroom instruction. Student-centered instruction is different than the traditional forms of instruction prevalent in today's classroom. The traditional form of instruction can be described as students sitting passively while teachers deliver content that they are expected to repeat for a test. Kingsley & Brinkerhoff (2011) state that this form of instruction "focuses on low-level thinking skills and risks being perceived by students as boring and disconnected from their lives" (p. 9). This method is not beneficial to student knowledge acquisition and can be overcome with more student-centered approaches that allow for more collaboration and creativity. Through these approaches, student achievement most often increases (Sousa, 2008; Kopcha, 2010; Hew & Brush, 2007; Carle, Jaffee, & Miller, 2009; Cutrim, 2008; Gülbahar, 2007; Kim & Hannafin, 2011; Mann, 2008).

The use of technology can increase student interest and investment in the content. Wolf, Lindeman, Wolf, and Dunnerstick (2011) state "integrating technology enables students to become more active in the learning process. When a student feels that he or she is more vested in actual learning, retention of the material tends to rise significantly" (p. 557). Student-centered instruction utilizes authentic assessments that provide a glimpse into the students' understanding of a topic. Computer and "web-based activities can encourage learners to construct and communicate knowledge in divergent, creative

ways" (Kingsley and Brinkerhoff, 2011, p. 9-10). Creativity can be stimulated when students are allowed to use technology. Greenhow, Robelia, and Hughes (2009) state that technology, such as Web 2.0 tools, has the "capacity for content creation and 'remixing' practices, in which a range of found or original online materials are cut, spliced, edited, reworked, and mixed into new creations" (p. 249). Basically, Web 2.0 tools require no software to be downloaded to a local computer; rather the software is on the Internet, making it accessible from any Internet-connected computer. By using these tools, users can connect, collaborate, and create with others either locally or globally. Common Web 2.0 tool categories include blogs, wikis, video creators, and social networks. Teachers can utilize these new creations as proof of student understanding.

Professional development is the first approach for teachers to learn more about how to create student-centered classrooms. Martin, Strother, Beglau, Bates, Reitzes, & Culp (2010) describe the importance of high-quality professional development as "central to any education improvement effort, particularly those that seek to integrate technology in support of classroom instruction" (p. 53).

Given the value of student-centered instruction and the value of technology in the classroom, the benefits of integrating the two can increase student achievement. This study was designed to examine a possible approach to providing technology training to a teaching staff in an effort to increase the use of student-centered technology use in classrooms.

Overview of the Issue

Instructional technology integration is defined as "the use of computing devices such as desktop computers, laptops, handheld computers, software, or Internet in K-12 schools for instructional purposes" (Hew & Brush, 2007, p. 225). This integration of technology into instruction is well documented as an important component of student learning (Sousa, 2008; Kopcha, 2010; Hew & Brush, 2007; Carle, Jaffee, & Miller, 2009; Cutrim, 2008; Gülbahar, 2007; Kim & Hannafin, 2011; Mann, 2008). Technology use creates higher student engagement by providing opportunities that were not possible without the technology. For example, using technology, students are able to talk, collaborate, question, and create with other students as well as experts that geographically were inaccessible previously. By using free video conferencing software these formerly geographically impossible opportunities might come in the form of class discussions with an author of a novel under study, or connecting with students around the world to explore different cultures.

While the prevalence of technology in classrooms is increasing, its use is more teacher-assistive than student-centered (Hixon & Buckenmeyer, 2009; Hermans, Tondeur, van Braak, & Valcke, 2008; Gorder, 2008). Teacher-assistive technology is described by Liu (2011) as technology used by teachers to "design instructional materials or deliver lectures" instead of as a "learning device" in the hands of students (p. 1012). These technologies include the use of document cameras, laptops, and projectors to deliver content to the student. This model contrasts with a student-centered approach that would use technology as tools for students to create and make sense of their learning. Kopcha & Sullivan (2007) explain student-centeredness as "focusing instruction on the

knowledge and skills needed by learners rather than on the delivery of content" (p. 630). For example, a teacher delivering content to students via Microsoft PowerPoint is not a student-centered approach; however, students who use Microsoft PowerPoint to design a presentation of their understanding of a topic are using a student-centered approach.

Despite the increased amount of technology in classrooms, many barriers to technology integration exist. Brinkerhoff (2006) describes technology-related barriers as "any factor preventing or restricting teachers' use of technology in the classroom" (p. 22). Barriers most discussed in literature include: (1) attitude, (2) time, (3) access to technology, (4) school culture, (5) knowledge & skills, (6) support (Hixon & Buckenmeyer, 2009; Hew & Brush, 2007), (7) ability (Velazquez, 2007), (8) high stakes testing and accountability (Hew & Brush, 2007), (9) teacher interest (Niederhauser & Perkman, 2008), and (10) professional development goals (Hixon & Buckenmeyer, 2009).

These barriers actually form a complex web, such that removing one barrier does not necessarily pave the way for increased technology integration. Instead, it may simply shed light on a new barrier that was not considered before and must now be overcome to move forward with integration. For example, overcoming the lack of access to technology does not necessarily make the lack of teacher interest or ability any easier to overcome. Instead it may just translate the focus from that barrier to the next barrier that presents itself while trying to integrate technology.

Most of these barriers can be overcome through the planning and delivery of high-quality training during professional development opportunities. However, the traditional professional development model is insufficient for the training of the average

teacher to implement technology (Cuban, Kirkpatrick, & Peck, 2001). This traditional model can be defined as training that "teachers are [all] expected to attend…regardless of their readiness and/or interest in the topic. The training sessions are usually based on a 'one-size-fits-all' model where individual differences and learning styles are not taken into consideration" (Hixon & Buckenmeyer, 2009, pp. 141-142). Mouza (2002) found that training that utilizes a traditional professional development model and does not provide any follow-up after the training is ineffective in helping teachers implement technology into the classroom. Most of the suggestions for effective professional development hinge on the idea that while schools are developed mostly for student learning, schools should also be a place where teachers can learn and grow as well (Collison, et al., 2009).

Since teachers learn differently, have individual experiences that help or hinder them when learning technology, and face their own set of unique barriers to technology integration, using a professional development model that differentiates instruction for each teacher would allow for overcoming their individual needs related to technology integration. Carol Tomlinson (2004) describes differentiating instruction as the process of "ensuring that what a [person] learns, how he/she learns it, and how the student demonstrates what he/she has learned is a match for that [person's] readiness level, interests, and preferred mode of learning" (p. 188).

Making professional development meaningful for teachers is important to the implementation of long-lasting reforms to positively affect student achievement. Kesson and Henderson (2010) propose that professional development be differentiated for teachers by allowing them to, "define their own learning needs" (p. 225). Flanagan and

Kelly (2009) propose what they refer to as "responsive professional development," in which

> principals must recognize that all teachers do not have the same skill set with regard to content knowledge and pedagogy. Just as teachers respond to the varying needs of the students, professional development should do the same for teachers. To support teachers, principals must make plan and design (sic) effective professional learning opportunities to meet the varying teacher needs (p. 28).

Using a differentiated professional development model may give teachers the ability to overcome barriers that keep them from integrating student-centered technology in their lessons. By doing so, the use of technology could have the positive effect on student achievement that it is designed to have.

Statement of the Problem

Technology integration is too frequently used by teachers in ways that meet the definition of teacher-assisted technology, as illustrated in the typical use of a document camera and projector during instruction. While technology has a potential to positively impact student achievement when used in student-centered ways, teachers overwhelmingly continue to utilize technology for teacher-assistive tasks. A more student-centered approach would provide an opportunity for students to communicate with other learners or construct and display their own understanding of content. Kingsley and Brinkerhoff (2011) explain this by saying, "student-centered instruction is often both collaborative and constructivist in nature" and "leads to content acquisition equal to or better than that resulting from traditional instructional models" (p. 9). Constructing their own understandings of curricular content and working with others can lead to other benefits as well. Saye and Brush (1999) found that working in groups can help students

learn new content and can positively impact both social skills and attitudes toward school.

Traditional forms of technology professional development have not necessarily resulted in more student-centered technology experiences. Lawless & Pelligrino (2007) state that traditional forms of professional development do not use the best practices to bring about effective teaching and learning. Kesson & Henderson (2010) agree stating,

> staff development of teachers is more often like a fast-food cafeteria than a satisfying full-course meal: offerings might include isolated curriculum initiatives, the latest teaching fad, or increasingly, how to interpret test scores and teach to the test (p. 215).

According to the National Staff Development Council's Standards for Staff Development (2001), quality professional development "require[s] that planners select learning strategies that are appropriate to the intended outcome and other situational factors" (p. 22). This would indicate that in order to meet the needs of teachers, a professional development provider must utilize methods that are proven and match the intended outcome of the instruction. Using approaches to technology integration in professional development training that mirror teacher-assistive approaches will not be effective in bringing about student-centered teaching.

Because traditional professional development does not meet teachers' needs in relation to overcoming technology barriers, new methods must be implemented to support teachers so that they can more effectively integrate student-centered technology. Hixon and Buckenmeyer (2009) state that "successful technology integration calls for more personalized professional development that focuses on teachers' fundamental beliefs about teaching and learning" (p. 143).

Purpose of the Study

Given the call of researchers for professional development to meet the needs of teachers, this study was designed to examine a differentiated professional development model for technology integration. The purpose of this study is to determine whether using the differentiated professional development model can impact teachers' understanding of the uses of technology (teacher-assisted versus student-centered), assist teachers in overcoming natural barriers to technology integration, and increase their use of student-centered technology in the classroom. Specifically, the researcher's goal for this study is to assist teachers in overcoming his or her barriers to technology so that they may begin to implement technology in increasingly more student-centered ways in order to impact student achievement.

Model

The framework used for this study will be based upon a model designed by Kopcha (2010). In this framework (Figure 1), the author presents a model of technology integration that utilizes mentoring as the main component of the professional development model. The entire system begins with a needs analysis to find out the needs of each teacher. The mentor relies on teacher self-report data, observations, and interviews to determine a professional development goal for the teacher. The overall goal of the model is to assist teachers in recognizing and developing student-centered technology use in classrooms.

Once the needs assessment is completed, the mentor will determine the vision for professional development for each teacher and will set short- and long-term goals to

reach that vision. These goals can be individualized for each teacher, or for small groups of people in similar content area, grade level, or ability level.

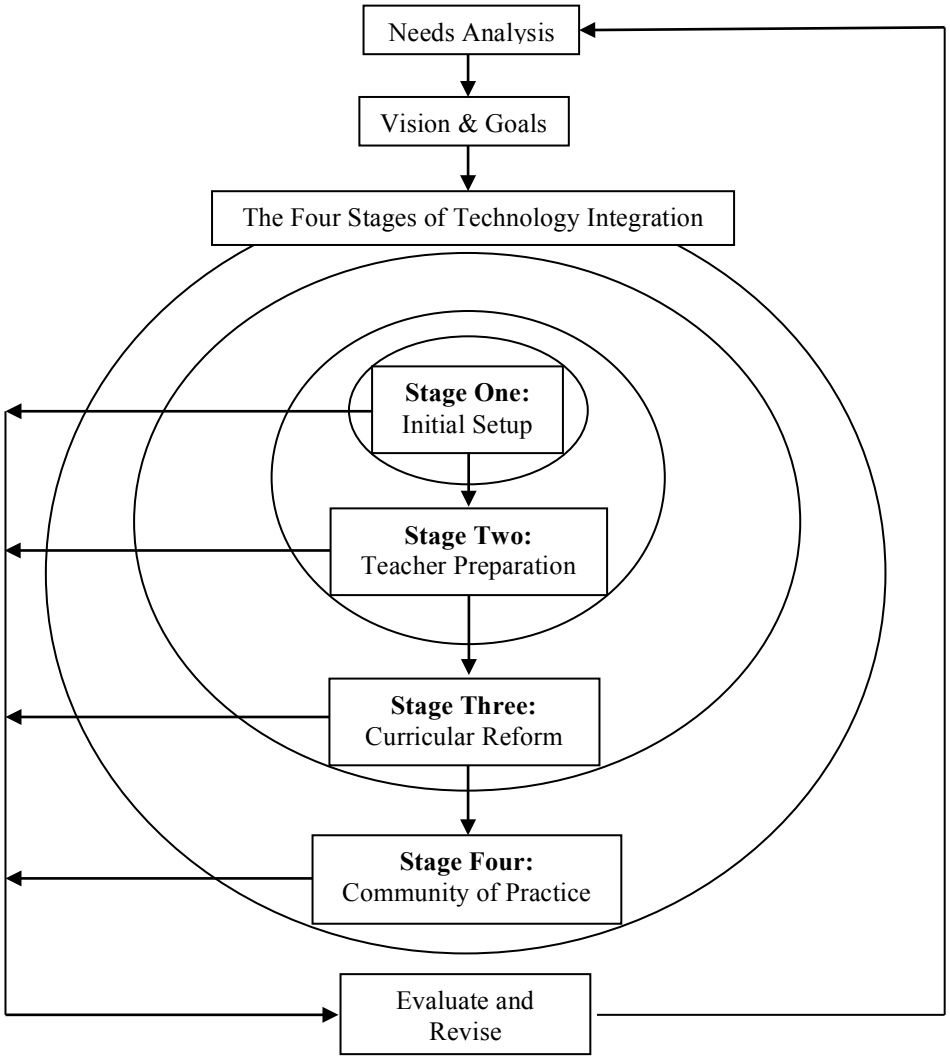

Figure 1: Kopcha's (2010) system-based mentoring model

Following the needs assessment and goal setting, the four stages of technology integration begin. Stage one involves the initial set-up of the technology. Mentors will work with teachers to eliminate any barriers that may keep teachers from using the technology. This stage would include helping to provide access to the technology, teaching the teacher about the technology and its uses, and providing basic

troubleshooting steps that the teacher can follow should issues arise when using the technology in class.

Stage two deals with the identification of how the technology looks when being used in student-centered ways. In this stage the mentor helps the teacher locate lessons that integrate student-centered technology and provides access to observe other teachers who are using the technology in a student-centered way.

Stage three is focused on guiding the teacher through creating original lessons using the technology in student-centered ways. During this stage, the teacher writes new lessons or transforms old lessons to include technology.

Finally, stage four is designed for the mentor to assist the teacher with the set- up of a community of learners (on- or off-campus) that have a similar interest in the technology or who are using the technology in student-centered ways already. This step removes the mentor from the process while the teacher continues to master the technology with the help of the new community of learners. Additionally, in this stage, the mentor trains teachers to become leaders in technology integration at the campus level.

Success in each of the four stages depends on four areas related to technology integration (represented by the circles in Figure 1). These four areas must be addressed before any stage in the model can be completed: mechanics (refers to proper set-up and troubleshooting issues); systems (methods to use technology to reduce management issues related to integrating technology); culture (attitudes and beliefs of teachers); and curriculum (integrating the technology into lessons with student-centered approaches). While each of these four areas related to technology must be addressed in each of the

stages, it should be noted that in some stages the areas may be more important than in others. For example, in stage one, Initial Set-up, mechanics is much more important to overcome than curriculum. In stage four, Community of Practice, the teacher may have to spend less time overcoming mechanics than they will in developing a culture or working with the curriculum. It is important that throughout the entire process, the teacher not move backwards to previously learned steps or technologies. Learning a new or different technology should not cause a teacher to forget how to use a technology that they previously mastered.

Finally, after all four stages have been completed, the mentor will evaluate the effectiveness of each plan that was created at the beginning stages of the cycle, measuring the progress made toward each goal . The process is intended to be iterative, so a new technology can be selected and the mentor and the teacher can repeat the four stages with the new technology.

Significance of the Study

Kesson and Henderson (2010) call for professional development that (a) offers "new instructional methods to teach challenging content;" (b) develops the "capacity to teach to a variety of learning styles and differentiate instruction;" and (c) creates "learning communities for discussion and reflection with colleagues about best practices" (p. 216). The results from this study could inform teacher leaders by evaluating whether a professional development model that differentiates does, in fact, promote student-centered technology integration. The results of this study will benefit teachers because professional developers will be better equipped to practice differentiated professional development, which allow teachers to receive individualized instruction on how to utilize

technology for instructional purposes. Buckenmeyer (2010) argues that while it is important to make technology available to all schools, it is equally important to get that technology used effectively in classrooms. Access to technology is only half of the problem; utilization must follow for technology to fulfill its purpose in classrooms.

Results of this study will inform and provide guidance to schools that could impact student achievement. By utilizing more student-centered activities, the schools will provide opportunities for students to make sense of and apply what they are learning. Liu & Szabo (2009) claim that the purpose of technology in the classroom is to encourage learning such things as abstract concepts by infusing communication into the lessons. "When using technology, students experience the information and are able to integrate previous experience and knowledge" (p. 6). If students are better able to construct their own learning, then technology can improve student achievement.

Research Questions

This study is designed to determine whether a differentiated professional development has an impact on the ability of teachers to integrate student-centered technology more easily into their classrooms. The idea is that teachers need more individualized instruction in order to master technology integration. To this end, the following research questions will guide this study:

1. How does a differentiated professional development model impact teachers' implementation of "student-centered technology" integration?
2. How does a differentiated professional development model impact the ability of teachers to overcome natural barriers to technology integration?
3. How does a professional development model with a structured mentoring plan impact teacher's growth in regards to uses of student-centered technology?

Research Design and Methods

The study will be conducted as a descriptive multi-case study, employing thick-descriptive data to explain three cases studies that are bounded by location (one school), time (one semester), teaching assignment (core content area teachers), and experience in teaching (must be in at least their third year of teaching).

Bogdan and Biklen (2007) describe qualitative research as descriptive because the "data collected take the form of words or pictures rather than numbers" (p. 5). Because of this, they go on to state that,

> In their search for understanding, qualitative researchers do not reduce the pages upon pages of narration and other data to numerical symbols. They try to analyze the data with all of their richness as closely as possible to the form in which they were recorded or transcribed (p. 5).

The narration resulting from a qualitative design calls for thick description, which Merriam (1998) defines as "the complete, literal description of the incident or entity being investigated" (p. 30). Thick description allows the researcher to detail the entire process and identify themes that emerge from the narration. Merriam (1998) goes on to state that the purpose of thick description is to enable "readers will be able to determine how closely their situations match the research situation, and hence, whether findings can be transferred" (p. 211).

Yin (2009) identifies one of the purposes of qualitative research, specifically case study, as a way to "describe an intervention and the real-life context in which it occurred" (p. 20). Using a case study methodology with thick-description and real-life context will allow this study to identify the impact, if any, of a differentiated professional development on teachers. Creswell (2007) describes a multi-case as one in which "the one issue or concern is again selected, but the inquirer selects multiple case studies to

illustrate the issue" (p. 74). Selecting multiple cases will allow the researcher the ability to more richly describe how diverse teachers respond to a differentiated professional development model with respect to their own technology integration.

Since there is very little research base related to using a differentiated professional development model in relation to technology integration, a descriptive case study is appropriate. Merriam (1998) states that a descriptive case study is useful when studying educational areas with little research base. Oftentimes, she states, the focus of descriptive case studies are "innovative programs and practices" (p. 38).

Study Background

The researcher is one of two Instructional Specialists in an urban middle school serving 450 students. One of the job requirements of the Instructional Specialist is to train the staff on programs and initiatives that the building principal wants implemented at the school. One initiative that was selected by the principal was the integration of technology into the curriculum.

Prior to this school year, the researcher held the same position of Instructional Specialist at an intermediate school campus of about 750 students in the same urban school district. The second Instructional Specialist was the same, as was the school principal. By having the same leadership team for multiple years, the researcher was able to employ multiple models of technology integration prior to this study.

Originally, both schools included a Professional Learning Community (PLC) period in addition to their conference period each day. Teachers in the English Language Arts and Mathematics departments had one of the two Instructional Specialists leading their PLC period. In these daily meetings, the Instructional Specialist would set the

agenda and run meetings based on the needs of the department. A weekly format was set up by the Instructional Specialist to help facilitate more productive meetings with the teachers. One of the days of the week was named "Technology Tuesdays" and was used by the Instructional Specialist to demonstrate the various technologies available in the building. These trainings did not focus on the student-centered uses for technology, but were meant to give teachers an opportunity to look at and familiarize themselves with the hardware that was available on campus.

In the second year, while at the middle school, a decision by the superintendent's office forced a school day restructuring that did not allow the campus to continue using PLC's during the day. This forced the Instructional Specialist team to rethink how to provide professional development to the staff. One of the solutions was to continue with the "Technology Tuesdays" name but introduce a new format. This new design would have all teaching staff members attend a weekly twenty-minute training immediately after school. Great care was taken in the planning of these trainings to make sure that the time was used most efficiently and was enjoyable. Prizes, contests, snack, and weekly themes were used to try and increase teacher buy-in to the integration of technology.

Procedures

Because the staff was required to attend the weekly "Technology Tuesday" trainings, the researcher utilized one of the sessions to introduce the study and requested teacher participation. An outline of the study, requirements of participation, and rights of the participants were presented. Teachers who agreed to participate were asked to spend the remainder of that particular "Technology Tuesday" meeting completing responses to the Massachusetts Technology Self-Assessment Tool, from here on after referred to as

the TSAT (Massachusetts Department of Elementary and Secondary Education, 2013). This assessment required participants to put a checkmark next to items for which they had confidence in doing. These items are grouped into what the TSAT refers to as standards related to technology: 1) Technology Operations and Concepts, 2) Ethics and Safety, and 3) Teaching and Learning with Technology. Based upon the survey results, the researcher sorted the participating teachers into one of four groups: Early Technology, Developing Technology, Proficient, and Advanced. To provide participants the most benefit in the short time of the study, the researcher focused on the two middle categories, Developing Technology and Proficient. Participants in the Early Technology group will have many barriers learning the new technology, some of which might be low knowledge and skills, affect, or interest in the technology. It was determined that the short time frame for this study may not provide adequate time for these teachers to make observable growth to report. Conversely, the Advanced group will not benefit as much from the one-to-one assistance provided within this study framework, since these teachers are regularly utilizing technology. Again, observable growth in this group may also take time that is not allowed for within this study. It was determined that the best opportunity for observable growth would be from using the Developing Technology and Proficient groups because these are teachers that have few barriers keeping them from utilizing the technology. With the assistance that could be provided within the study framework, these teachers could move quickly past those barriers.

Once a potential pool of participants was selected, the researcher randomly assigned a number to each participant and used a random number generator (www.random.org) to select three participants to participate in the study. The three

selected participants participated in a one-on-one differentiated professional development model with the two Instructional Specialists, while the remainder of the staff only participated in a traditional professional development format. Because they were participants in this study, these three participants were no longer required to attend the "Technology Tuesday" trainings but were allowed to attend if they desired.

An initial interview session took place to begin to explore each teacher's beliefs, attitudes, barriers, and aspirations with respect to technology integration. The researcher conducted a minimum of three classroom observations of each participant in order to determine when and how they use technology in a lesson. A triangulation analysis of each teacher including the barriers they faced (both stated and observed) and their stated technology aspirations for their classroom were conducted. This data came from the TSAT data, the initial interview, the observation data, and what the researcher already knew about the teachers from working with them as their Instructional Specialist. For the purpose of this research study, the researcher focused only on Standard 3 of the TSAT (Teaching and Learning with Technology), because it addresses the integration of technology into the learning environment. Once this analysis was completed, the researcher, the other Instructional Specialist, and the teacher met to go over the researchers' findings, as well as to identify a specific plan of professional development together as a team. In this meeting, the researcher:

1. Explained what data had been collected and how the researcher analyzed the data to prepare for this meeting.

2. Described barriers discussed in research and provided documentation (quotes, observations, etc.) that indicated whether or not the teacher has shown signs of each barrier.

3. Listed the aspirations that were indicated in the initial interview.

4. Explained the Kopcha (2010) model used in their differentiated professional development for the semester.

5. Allowed the teacher to select a technology to focus on for his or her own development.

6. Brainstormed any barriers or logistics that may need to be considered when implementing that technology. These barriers are ones that are imperative to overcome, such as access to the equipment.

7. Allowed the teacher an opportunity to discuss specific ways that he or she would like to use the technology in their classroom, as well as any specific requests or needs that they might have.

8. Identified two days a week that the teacher was able to meet with the researcher and/or the other Instructional Specialist in order to have differentiated training for about 30 minutes each meeting.

Upon completion of these meetings, the researcher and/or the other Instructional Specialist made themselves available for "just-in-time" training. This means that if one of the study participants needed support regarding technology integration, the researcher and/or other Instructional Specialist was available immediately to offer that assistance. The researcher kept a log showing when "just-in-time" training had been requested, what assistance was needed, and what support was provided.

To facilitate better use of time during the differentiated professional development training sessions, the researcher wrote weekly lesson plans indicating what the researcher and/or other Instructional Specialist focused on during each session. Because these trainings were differentiated, each study participant's needs and desires took precedence over the lesson plans. The researcher also kept anecdotal notes during each training session to document how the time was spent during each session.

Teacher lesson plans were collected weekly in order to allow the researcher to identify times when teachers planned on using technology in their lessons. This allowed

the researcher and/or other Instructional Specialist to know when their assistance might be needed in one of the participant's classrooms and gave the researcher an opportunity to observe the teacher using the technology.

Along with the "Technology Tuesday" trainings, the researcher and other Instructional Specialist implemented a monthly blog challenge called the "Brag Board Awards." The purpose of the contest was to allow teachers an opportunity to discuss how they were using technology and to give other teachers on campus ideas of ways to incorporate technology into their classrooms. All teachers on campus were encouraged to post about their use of technology on the Instructional Specialists' blog. Each month three winners were chosen, announced during "Technology Tuesday" training and awarded gift cards. The researcher kept track of the blog posts from the three study participants to note how they were using technology.

At the conclusion of the study, the researcher conducted a final interview session with each participant. During this interview, the researcher:

1. Asked the participant to design a second individualized professional development plan. This was done whether the first plan had been completed or not. The purpose of creating a second training plan was to give the researcher an idea of what the participant would like to accomplish next. This showed how ambitious the participant was after participating in a differentiated professional development model.

2. Brainstormed any barriers or logistics that may need to be considered if the second professional development plan was actually implemented.

3. Allowed the teachers an opportunity to discuss specific ways that they would like to use the technology in their classrooms, as well as any specific requests or needs that they might have.

Following the creation of the second training plan, the researcher conducted the final interview questions, most of which were the same questions asked in the initial

interview. In addition to the original questions, the researcher also explored how each participant felt about the differentiated professional development model versus a more traditional professional development model. They were also asked what components they would want in a professional development model if they could design it themselves.

Following the final interview, the researcher added the final interview data to the original triangulation analysis document (TSAT, initial interview, observation, and what the researcher knows of the teacher) in order to identify trends. A comparison between similar questions on the initial and final interview was conducted to look for trends and themes emerging from the data.

Participants

The three teachers selected were all from an urban middle school of about 450 students. The teachers all taught core subjects (mathematics, English Language Arts, science, or social studies) and were in at least their third year of teaching. The participants selected were required to provide consent to be in the study.

Limitations of the Study

One limitation of the study was that the researcher would be dependent upon teacher's self-reporting information during surveys and interviews. Hew and Brush (2007) state that, "self-reported data may not give an accurate depiction of how technology is actually used because teachers' beliefs, intentions, or perceptions do not always translate into practice" (p. 246). Because of this issue, the researcher coupled teacher-reported data with observations conducted by the researcher to determine a more accurate picture of each teacher's technology integration.

Delimitations of the Study

While the scope of this study could be much larger, it was limited to only one campus in one school district. Because of the use of case study as the qualitative methodology, only three teachers were selected for the research group.

Definitions

The following definitions will be used throughout the study:

Differentiated Professional Development – the individualization of trainings to meet the needs and interests of teachers in order to master the goals of the professional development session. Includes support provided to the teacher through the entire implementation process.

Traditional Professional Development – professional development sessions that follow a typical lecture or whole-group format. In this type of training, teachers may sit passively listening to a speaker or set of speakers and then be expected to implement the goals of the session on their own following the training.

Student-Centered Technology – the selection of technology by students as a tool of choice that assists them in solving the problem at hand.

Teacher-Assisted Technology – the use of technology for the purpose of delivering content to students through traditional means of instruction (lecture, whole-class instruction, etc.).

Support – both of the following definitions are critical to teachers implementing technology in their classrooms: 1) the assistance given to teachers following a professional development session. The purpose of the support is to aid teachers in implementing the goals of the session, 2) the encouragement of the school administration

by provide working technology, expecting teachers to apply technology to their lessons, and offering high-quality professional development opportunities that will assist teachers in implementing technology appropriately.

Conclusion

Technology is very prevalent in a large part of our society and its innovations move at a very fast pace. Unfortunately, schools and educators are unable to keep up with the same pace as they attempt to integrate the technology into the classroom. But because of technology's prevalence, it is no longer a viable educational option to withhold technology from students during the learning process. Access to technology is increasing in many schools but student-centered integration of the technology is not. Teachers primarily use technology for administrative duties (for example, taking attendance) and presenting content to students by way of Microsoft PowerPoint, which provides information in a simple slide show format that follows a linear pattern.

In order to use technology in the classroom, teachers need to understand how to use the technology for themselves. This does not come naturally for many teachers and cannot be addressed in traditional professional development that Kesson and Henderson (2010) call a "one-shot infusion of new ideas" (p. 215). Research suggests that professional development opportunities be structured in such a way that each teacher is assisted with the technological barriers they he or she faces. This professional development should be differentiated and personal for each teacher. This study proposes to look at such a professional development model to identify whether it better helps teachers integrate technology. The literature base, described in the next chapter, helps to identify the impact of professional development and technology integration on both

teachers and students. It will also indicate a need for this current research study to be conducted.

CHAPTER TWO

Review of Literature

Much like students, teachers learn differently and may require individualized attention in order to reach educational goals. However, professional development opportunities designed for teachers are done so in an effort to move through as many teachers as possible in the shortest amount of time, similar to the assembly line concept in manufacturing. This low cost, fast production leaves teachers with little time to process, practice, or question the educational integrity of the trainings being offered. Oftentimes teachers need the most assistance to implement any training concepts when they are lesson planning hours, days or even weeks after the training. A differentiated approach to professional development could change all of this and help teachers make the targeted changes in their practice.

One area of professional development that requires the most attention following trainings is in relation to technology, specifically student-centered technology. The integration of technology is a necessity in order to prepare students for a future that will likely surround the core concepts of a 21st Century education. According to Rosefsky Saavdedra (2012), "The interconnectedness of our global economy, ecosystem, and political networks require that students learn to communicate, collaborate, and problem solve with people worldwide" (p. 8). The Partnership for 21st Century Skills (2009) has researched and outlined the skills that will be necessary for students to master in order to be successful in the 21st Century. These include skills related to traditional education (reading, writing, and mathematics), but also include creativity and innovation, critical

thinking and problem solving, communication and collaboration, information literacy, media literacy, and technology literacy. It is important that we prepare students to master each of these 21st Century Skills so that they can meet the future with success.

Much research has been done in regards to professional development and technology integration as separate entities. Uniting the two is important for helping teachers find success as 21st Century educators. Within the literature base that points to using differentiated professional development for technology integration several research themes emerge. Technology integration itself is important to research, first, because of its ability to significantly impact student achievement with its connection to the younger generation, and second, because of the numerous barriers that teachers must overcome in order to implement it into their classroom. Two types of technology integration, teacher-assistive and student-centered, are utilized in today's classroom, but student-centered has a much greater impact on success in classrooms.

Professional development models are also important to discuss because of the forms through which professional development has been traditionally delivered. These models serve as the primary ways in which teachers learn and apply new skills. The ways in which information is delivered to teachers can help to support or thwart the objectives of the training, especially since teachers, just like students, learn in different modalities. Therefore, differentiating the training has the potential to foster greater success of professional development objectives.

Research is limited about utilizing a differentiated model for professional development. Using a differentiated approach has been called for by researchers, but rarely implemented in a research study capacity. It is important that education continue

to search for ways to improve student achievement and assist in preparing the next generation with skills that they can use in their future. Finding ways to help teachers overcome natural barriers to technology integration and connecting them with a high-quality effective professional development are essential to appropriate integration of technology into classrooms. With the educational benefits that come from effective technology use, students will be prepared for success in a 21st Century world.

Technology Integration

Technology Integration is a well-researched component to student learning (Sousa, 2008; Kopcha, 2010; Hew & Brush, 2007; Carle, Jaffee, & Miller, 2009; Cutrim, 2008; Gülbahar, 2007; Kim & Hannafin, 2011; Mann, 2008). Its ability to connect students to information outside of the classroom can assist students in making sense of the classroom learning objectives. The ability to connect classroom learning to real-world experiences will allow students to retain and understand learning at a much deeper level. In one of educations most seminal writings, Ralph W. Tyler (1949), states that learning occurs because of what the student does rather than what the teacher does. While the teacher presenting material is important, the type of learning to which Tyler refers means that students are able to move fluidly between their own understanding of each school subject as well as their understanding of school learning and how it relates to solving problems in the real world. This type of understanding is called "master understanding" by Mansilla and Gardner (1998), meaning that students are able to solve new and unique problems by pooling together what they know and often build new, creative, and innovative solutions to solve the problem.

Utilizing technology to assist students in making sense of the world is also well documented in the literature. In *How People Learn*, the National Research Council (2000) state that the use of computers helps students solve more complex problems and make sense of learning that would be difficult without the technology. By allowing students to free up some of their working memory required to visualize the problem at hand, technology allows students to develop higher levels of thinking (Jonassen, 2003; Greenhow, Robelia, & Hughes, 2009). There is evidence that technology can assist in the acquisition of basic skills for elementary students from low-income households (Linebarger, 2011) as well as bringing real-life contexts into the classroom. Web 2.0 tools have enabled learning opportunities that transcend the four walls of the classroom through online collaboration and participation. These opportunities help to make students learning much more meaningful and relevant to the world around them (Greenhow, Robelia, & Hughes, 2009).

Despite the benefits of technology integration, teachers still struggle with integration in their classrooms because of various barriers. Many of these barriers may or may not be related directly to the control of the teacher. As a matter-of-face, barriers to technology integration can be linked to what Rotter (1966) called intrinsic and extrinsic locus of control. For those with extrinsic locus of control, overcoming barriers are contingent upon someone else fixing some perceived problem. Those with an intrinsic locus of control overcome barriers because they believe they have the abilities and skill set to overcome them on their own. Barriers, related to either intrinsic or extrinsic factors, are outlined in research and fit into four major categories, each discussed below.

Teacher Affect

The first category, teacher affect, relates to the feeling or emotion that a teacher feels regarding technology. Because how a teacher feels about technology is the first barrier they will face when deciding whether or not to implement technology, the affect barriers are critical to overcome. The affective barriers are attitude, teacher interest, and time. Without a strong affect toward technology, teachers will mostly likely view technology in a negative light, resulting in minimal integration or no integration at all. Without an interest, ability to give time to explore and learn the technology, or a positive outlook for the use of technology, most teachers will overlook the benefits to student achievement, and remain at the same level of integration they are currently maintaining.

One of the most discussed affects in research is attitude (Hixon & Buckenmeyer, 2009; Hew & Brush, 2007). Because attitude affects motivation (Stiggins, 2008), teachers are unlikely to integrate a technology when they do not feel strongly about their ability to use the technology effectively, the purpose behind why they should use it, or whether it is a better educational payoff than their standard way of teaching. This attitude toward technology can keep teachers from ever trying to use technology. If they cannot get past trying it, they will never be able to see advantages that students might gain from its integration.

Interest, another affective barrier, is related to teacher attitude but is more about a teacher's desire to learn about the technology and determine whether there is benefit to using it in the classroom (Niederhauser & Perkmen, 2008). Not all teachers are interested in implementing technology despite knowing that research shows that it is impactful. The National Research Council (2000) says that the use of technology can "enhance

student performance" (pg. 216), and Papert (1993) classifies it as transformative in the classroom. Despite this research, some teachers just do not see the impact nor do they want to utilize technology as a teaching tool, most likely because of their affect toward technology integration.

Time is also a barrier that fits within the teacher affect domain (Hixon & Buckenmeyer, 2009; Hew & Brush, 2007). Teachers often cite their inability to incorporate technology because it is more to them than "plugging it in and using it." Time is needed to learn about, figure out how to use, and to create a lesson that incorporates the technology effectively. Once it is ready to be implemented into a lesson, a teacher must understand how to troubleshoot (which often needs to be conducted in the middle of a lesson taking precious teaching time away from the already short class time), and to figure out how best to evaluate the effectiveness of using the technology. Learning how to troubleshoot and how to evaluate require more of the teacher's time.

Teacher Aptitude

The second category of barriers related to technology integration is teacher aptitude. This category can be defined as a teacher's ability to use technology effectively. The teacher aptitudes are knowledge and skills and ability. While these two seem similar, they each have their place in assisting a teacher overcome the aptitude barrier. Both knowledge and skills and ability help teachers apply technology successfully as they integrate it into their lessons.

The first aptitude, knowledge and skills (Hixon & Buckenmeyer, 2009; Hew & Brush, 2007), relates to a teacher's aptitude in using a particular technology. As mentioned previously, using technology is more than just "plug and play;" it requires

understanding of technology, its purposes, its abilities to augment a lesson or activity, how to troubleshoot, and how to evaluate it. Pertinent to knowledge and skills is also the need for teachers to be able to make certain that the technology is not the focus of the lesson, rather the content that the technology is used to highlight. Teachers with good knowledge and skills are able to effectively integrate a particular technology into a lesson, troubleshoot it in the event something goes wrong, and envision new ways to use that same technology for other lessons. An example might include a teacher becoming familiar with and mastery of a tool such as Microsoft PowerPoint. Having knowledge and skills for PowerPoint would mean that a teacher can create a slideshow, change layouts, add transitions, present the slideshow, and troubleshoot the program if something did not go as planned.

Similar to knowledge and skills, Velazquez (2007) identifies ability as another barrier. This barrier differs from knowledge and skills because ability is when knowledge and skills from a particular technology are transferred to a similar technology. Coupled with ability is the courage to try to use a new technology because one has the abilities in technology that enables transmission of knowledge from or about another technology to the new technology. In general, this transmission of skills is what makes ability different from knowledge and skills, which generally refers to using one technology while ability refers to the aptitude to use technologies. Following the PowerPoint example from above, ability would mean that a teacher is able to translate what they know about PowerPoint and effectively employ a similar tool with the same purpose, such as Keynote or Prezi. Both of these are presentation software, similar in function to PowerPoint but different in how the teacher creates the slideshow.

School Function

The third category of technology integration barriers is school function. This category relates to barriers that are caused by how the purpose of school, student achievement, is carried out. These barriers may or may not be influenced by the administration, but are generally bigger than just decisions made by an administrator. The school function barriers include school culture, professional development goals, and high stakes testing and accountability.

Hixon & Buckenmeyer (2009) and Hew & Brush (2007) also state that school culture is a barrier to technology because a campus administration that devalues technology will not encourage its use nor will it use any discretionary funds to fix, upgrade, or increase its technology inventory. Such a culture can be a struggle for teachers who want the technology but may have limited access to it. Other factors that influence school culture may include school staff, parents, local community, and legislation, among others. A culture that does not value the use of technology in the education of students will impact the decisions of teachers to integrate it into their lessons.

Professional development goals (Hixon & Buckenmeyer, 2009) can also be a barrier that teachers are forced to try to overcome. Because administrators often set these goals, they are guided by what the administration values. If the administration does not value technology, then the professional development provided to the staff will not include mastering technology goals. Professional development goals can also be influenced by other entities (School Boards, State or Federal Government), which may or may not focus on technology integration. When these goals are not initiated from the specific needs of

each individual teacher, they hinder the ability of teachers to utilize their professional development time for trainings that would assist them in integrating technology effectively.

High stakes testing and accountability is referred to as a barrier by Hew and Brush (2007) because of the constraints they put on the teacher and the classroom environment. Because classroom time is so precious when considering how many objectives need to be covered and what little time there is to cover them, teachers feel that they don't have time to waste in integrating a new technology. This barrier is especially significant in light of several of the previously discussed barriers, such as time, access, culture, and knowledge and skills. If high stakes testing and accountability drive the school culture, little focus will be spent on acquiring new technologies, much less providing opportunities for teachers to learn how to integrate technologies.

School Structure

The fourth category of technology barriers is school structure. These barriers have to do with how school is set up to accomplish the business of education. From the structure of the school day to the faculty available for various tasks, overcoming these barriers is integral in providing opportunities for teachers to integrate technology. The barriers related to school culture include access to technology, time, and support.

Access (Hixon & Buckenmeyer, 2009; Hew & Brush, 2007) to technology is a huge barrier relating to school structure. A disparity between schools due to local funding leaves some schools with more and better technology than others. Lower income schools tend to have less and what they have may be outdated or non-working equipment. Larger technologies (rolling smart boards, laptop carts, etc…) may also need to be shared

within a building. This disparity can make getting the technology on a day when it could be most beneficial a challenge a teacher has to work around others schedules as well. Teachers without access to technology have no need to use technology in their lessons. If access is unpredictable and unreliable, teachers quickly abandon any desire to integrate technology.

Time (Hixon & Buckenmeyer, 2009; Hew & Brush, 2007) is a barrier that can also fit within the category of school structure. Some schools give teachers time during the day to explore and learn new technologies. While schools cannot always mandate teachers to focus on technology during their conference or other planning time, required teacher duties and requirements can force teachers to choose to forego exploring technology options for an upcoming lesson in order to meet their other staff responsibilities.

Support is also a barrier discussed by Hixon & Buckenmeyer (2009) and Hew & Brush (2007). This barrier refers to having a system in place to ask questions, collaborate with others about lesson planning or get troubleshooting advice. Without a strong support system in place, teachers are most likely not going to attempt to integrate technology. Whether having a colleague with whom to collaborate or a instructional technologist on staff, teachers need to know that they have someone to turn to should something happen that they do not understand.

All of these barriers can be thought of as a web, each connected to each other, or causing one another, yet it is impossible to pick one barrier, apply a strategy to overcome it, and then expect that effective technology integration will follow. Often, correcting one barrier may shed light on a new barrier that was not an issue before. For example,

working with a teacher on knowledge and skills with a technology and getting him or her comfortable with using it in class does not mean that access to the technology will get easier, or that finding support will happen, or that high stakes testing will go away so that the technology can be integrated easier. This is not to say that overcoming barriers is therefore pointless or that overcoming one is not making progress and a difference in encouraging technology integration. It is possible for a teacher to address one barrier and make positive gains towards technology integration. The important thing to remember is that we must start somewhere.

Student-Centered and Teacher-Assistive Technology

While the availability of technology for individual classrooms is increasing, its use is more teacher-centered than student-centered (Hixon & Buckenmeyer, 2009, Hermans, Tondeur, van Braak, & Valcke, 2008, Gorder, 2008). While using technology to automate manual tasks (taking attendance, sending an electronic version of a worksheet rather than using the copy machine, or communicating with parents via email rather than by phone) is beneficial to the student by freeing the teacher up to spend more time teaching the content of the course, many teachers also use the technology to instruct in "usual ways." For instance, many teachers use technology to design instructional materials, and present material to students in the form of lectures, but do not allow their students to use the technology (Hermans, Tondeur, van Braak, & Valcke, 2008; Gorder, 2008; Center for the Advancement of Research and Development in Educational Technology, 2009). Ross, Smith, Alberg, & Lowther (2004) found through direct observational data of approximately 10,000 classrooms, that teachers were either not using the computers in the class at all in class or were using them for basic skills such as

word processing or for basic skill practice. These types of skills do not require students to apply critical thinking skills. While technology is increasingly becoming more available for use, teachers tend to continue to use it for the most basic of skills or for management of the classroom responsibilities, such as attendance or creating worksheets to print off for students to complete.

A teacher-centered use for technology in classrooms is in contrast to student-centered technology, which places technology in the hands of students as tools to help create and make sense of their learning. This method also allows students to utilize technology to meet their own learning needs. Technology used in this manner promotes student engagement, higher order thinking skills, creativity, comprehension of material, application to real-world contexts, and transfer of knowledge to other content and problems (Ottenbreit-Leftwich, Glazewski, Newby, & Ertmer, 2010). Students are better able to make sense of their own learning and apply it to other situations when instruction is structured in ways that cater to the world in which they live.

An example of utilizing student-centered technology is to allow students to use the technology to assist them in finding the answers to problems posed by the teacher. These would not be answers readily searchable by Internet search engines, but rather large-scale questions that fit into the content. Once the problem has been posed, students would have the freedom to use the technology as one of the tools to fashion their answer just as they have access to textbooks and other reference materials in the classroom. Students would also be given opportunities to decide the best way to pose their solution to the question or problem that was posed to the teacher. This student-centered focus of technology use is made possible by teachers planning more what they want their students

to learn rather than spending so much time planning how they want their students to learn it. For example, a teacher might need his or her students to master Pythagorean Theorem. Traditionally, during lesson planning a teacher will spend time looking for and building activities to teach that concept. These activities might include creating a slideshow to teach about Pythagorean theorem, including examples to show, practice problems for students to work on, and a quiz or test to assess whether they have learned the concept. The entire planning time is focused on how the students will learn Pythagorean Theorem and the teacher's time during class is to deliver content to the students. This also employs technology in a teacher-centered way, through the use of a slideshow to only deliver content to the students. In a student-centered technology environment, the teacher might spend time trying to develop questions that would pit the student against a real-world situation in which the use of Pythagorean Theorem is needed. Once that question has been posed, the teacher is free to walk around, guiding and assisting students as they work to determine the best way to approach and solve the problem. The use of technology would be as one of the many tools that are available to the students to use as needed. Finally, students present the solutions to the question in a manner that makes sense to them, through whatever means they feel would show their knowledge, whether technological or other. In this example, the technology is not used because the teacher thought it made sense to use, but rather because it made sense to the students to use in that situation.

Professional Development

The way some professional development is designed is partly to blame for the large amount of teacher-centered technology use in classrooms. Professional

development is used to instruct teachers on the best ways and ideas to teach, but most trainings about technology integration are still given in lecture-style, focusing on what teachers need to learn about the technology rather than how they could best learn it (Gaytan & McEwen, 2010; Hixon & Buckenmeyer, 2009; Papastamatis, Panitsidou, Giavrimis, & Papanis, 2009). Training teachers in a "one-size-fits-all" style training only exacerbates the problem of integrating technology. Brinkerhoff (2006) describes this type of training as subjecting teachers to training or instruction that does not fit their needs or abilities and from which they can gain very little useful information or knowledge. Traditionally, technology training is taught on one of two levels: (1) introduction of the technology, and (2) application of the technology. Neither of these trainings can reach a diverse set of teachers whose technology affect and aptitude are at different levels. For instance, a professional development training that only introduces a technology will bore and alienate the technology user who has ability or knowledge and skills of the technology already. These teachers will leave with little to no useful information, rendering the training a waste of time and money. On the other hand, a training that shows the application of a technology might overwhelm a new user of the technology or a beginning technology user. These teachers will have trouble seeing past their lack of basic understanding of the technology. Because of this, the teachers will not understand any of the professional development objectives and will be unable to extrapolate any useful information from the training.

Liu & Szabo (2009) outline a seven-step process that teachers go through when implementing technology, whether student-centered or teacher-assistive. Level 0: Awareness – the teacher becomes somewhat aware of the technology and may have heard

a little about it, but has not ever tried it. Level 1: Informational – the teacher is interested enough in the technology to inquire about it, finding out basic information. Level 2: Personal – the teacher begins to understand the technology somewhat and is questioning whether it is worth learning. Level 3: Management – the teacher begins to look at how the technology might be used and how its functionality is useful to him or her. Level 4: Consequence – the teacher begins to ask whether the technology would be useful in a classroom setting, and begins to think of possibly utilizing it if he or she decide it is useful. Level 5: Collaboration – the teacher talks with others about the technology and how they might be using it, gaining ideas and tips on how to use it. Level 6: Refocusing – the teacher is ready to implement the technology in the classroom.

In order to lead teachers through this process and guide them toward more student-centered technology integration, it is imperative that good professional development and support become key components. Palak and Walls (2009) state that training should focus on helping teachers develop student-centered methodologies for their instruction. This is not an easy task, especially considering teachers need to be supported while learning how to implement student-centered technology. Mentoring programs or professional development opportunities can assist them in thinking through how to overcome each barrier that they face. Integrating technology is not a one-man show; it is a collaborative effort between campus culture, knowledgeable others, the teacher who is implementing the technology, as well as the students who are receiving the instruction.

Because educators and researchers spend a great deal of time studying the elements of good teaching, and how to make the most of instructional time, it only seems

that those same findings would also be a valid approach to instructing teachers in professional development opportunities (Beavers, 2009). According to Lawless and Pellegrino (2007), professional development opportunities for teachers typically do not utilize any of the research-based practices. While these best practices for teaching should be applied to professional development, Papastamatis, Panitsidou, Giavrimis, & Papanis (2009) indicate that teachers, as adult learners, do have slightly different learning needs than students, most notably the need "to give and receive feedback in relation to the relevance of the staff development programme" (pg. 88). Additionally, teachers, as professionals, need to be full participants in the development of their craft. Lawler (2003) states that doing so "creates goodwill and a cooperative environment" (p. 18). This cooperation is imperative for change and growth to occur within the teachers' practice. "If the goals of adult education and professional development are change and growth, then opportunities and strategies that empower the learner are essential" (Lawler, 2003, p. 19). Finding ways to teach effectively and empower the adult learner are critical in making the changes that each professional development is targeting.

Professional development has long been employed as a vehicle for teacher and school improvement. No matter what content is being taught, the same basic traditional format of training has been implemented. A "one-size-fits-all" training is used to train everything from testing procedures to integrating technology. Educators spend a lot of time looking at how students learn, but professional development often ignores the idea that teachers learn in many of the same diverse ways as students.

Sparks (2004) characterizes the professional development system in the U.S. as a two-tiered systems, the first of which focuses on developing teachers' own learning and

community (called tier one) and the second of which focuses on mandates and compliance with reforms handed down (called tier two). Tier one professional development tends to impart information to teachers in a way that forces them to be reliant upon what "experts" think is best for student learning. The teachers that are subjected to this professional development style do not have need to seek out new information or new learning in order to make their superiors happy; they simply need to follow the mandates set forth in the professional development opportunities.

The second tier of professional development seeks to develop in teachers the ability to build a community of learners, find their own knowledge and determine for themselves what learning needs to take place. Teachers that are subjected to this type of learning can be characterized by their ability to be independent learners, always seeking new and innovative ways to develop themselves and bring learning to their students. They tend to seek out communities of learners that help to engage their ideas and help them to continue to develop themselves professionally.

This two-tiered learning is found throughout the professional development literature. Collison, et al. (2009) discussed the concept of "single-loop" and "double-loop" learning. Single loop simply tries to change a teachers practice by telling them what to do, much like tier one in Sparks' discussion. Double-loop learning, on the other hand, seeks to change a teachers practice by impacting their beliefs about the practice. This can only occur when a teacher is an active participant in his or her own learning. Kesson & Henderson (2010) agree by stating that the typical professional development model, "is more often like a fast-food cafeteria than a satisfying full course meal: offerings might include isolated curriculum initiatives, the latest teaching fad, or

increasingly, how to interpret test scores and teach to the test" (pg. 215). According to Fullan and Hargreaves (1996), the typical professional development holds "a passive view of the teacher, who is empty, deficient, lacking in skills, needing to be filled up and fixed with new techniques and strategies" (pg. 17).

There are additional issues with the current typical professional development model. Most typical professional development is simply a "one-shot" approach, meaning the training is given in one sitting with little to no follow-up. Researcher indicates that lack of support is one of the major barriers keeping teachers from integrating technology. These types of trainings are rarely based on teachers' needs, thereby making them impractical and useless (Cuban, Kirkpatrick, & Peck, 2001). Also, the traditional form of professional development cannot meet the diverse needs of the teachers in every school and does not model good instructional practices for technology use. Gaytan and McEwen (2010) state, "professional development activities usually implemented are not necessarily guided by 'best practices' found through formal, scientific research" (p. 78). Without professional development opportunities modeling how to teach with technology, many teachers are unable to visualize how to implement technology into their classrooms in ways that do not replicate the direct-teach, teacher-assistive way it is presented in their trainings.

Professional development is important to the development of teachers; therefore its study can be found throughout the literature. While there are various forms of criteria for what effective professional development should look like based on research, some common characteristics emerge from research suggestions. Most of the suggestions for effective professional development hinge on the idea that while schools are developed

mostly for student learning, schools should also be a place where adults can learn and grow in their craft (Collison, et al., 2009).

First of all, effective professional development should contain a mentoring aspect. While some researchers stress this as most important for new and inexperienced teachers, most all who discusses it agree that it is effective for all teachers regardless of their experience (Kopcha, 2010; Martin, Strother, Beglau, Bates, Reitzes, & Culp, 2010; Renfro & Grieshaber, 2009). Mentoring is mostly conducted through collaboration between colleagues, teacher leaders and teachers, as well as in a mentor/mentee situation. Collison, et al. (2009) states "collaboration, especially through collective inquiry, is now widely accepted as necessary for teacher learning, for effective mentoring, and for the improvement of instruction" (p. 13). According to Davis, Ellett, & Annunziata (2003), the purpose of mentoring is that with "interactions between co-learners, professionals are able to use their knowledge on behalf of others while further developing their own knowledge" (p. 290). In other words, mentoring becomes a symbiotic relationship where both parties' benefit and both have valuable information and knowledge to offer each other.

Through the eMINTS (enhancing Missouri's Instructional Networked Teaching Strategies) study, Martin, Strother, Beglau, Bates, Reitzes, & Culp (2010) found that mentoring was an important piece of the professional development puzzle when attempting to help teachers integrate technology. Not only did they find that the professional development must include modeling for each other to help teachers integrate technology, but they also found that the more time that teachers spent with a mentor (in this case an Instructional Specialist), the higher the quality of lesson plans that were

implemented. They also discussed that when teachers participated in higher quality professional development, they tended to spend more time in reflective activities with their mentors, which allowed for greater understanding and longer impact of the professional development presented.

Secondly, professional development opportunities should be based upon teacher needs and interests (Brinkerhoff, 2006). Giving teachers the opportunity to make connections with the professional development by building on their own knowledge, understanding, and interests will allow them to implement the training much more effectively. Collison, et al. (2009) discusses the need for professional development to be based on real-world problems. They refer to this a "glocalisation," the idea that teachers need to be able to incorporate culture, values, and real-world problems into their curriculum by implementing a 'thinking globally, acting locally' mentality. This idea is also supported by Martin, Strother, Beglau, Bates, Reitzes, & Culp (2010), who call for active, inquiry-based learning connected to practice. All these ideas show a need for professional development to be based on teacher need, delivered in a timely fashion, and connected to classroom instruction. Professional development, then, needs to be different for each teacher in order to maximize the intended benefit of the training. This idea of different training for each teacher is the basis for differentiated instruction in professional development.

Differentiated Instruction

Traditional models of professional development do not work in assisting teacher as they integrate technology, and it is apparent that a new type of professional development be implemented (Brinkerhoff, 2006; Gaytan & McEwen, 2010, Hixon &

Buckenmeyer, 2009). This new type of professional development should be based on individual teacher needs. "Just as teachers respond to the varying needs of the students, professional development should do the same for teachers" (Flannagan & Kelly, 2009, p. 28). Beavers (2009) states that professional development "must recognize that teachers have different needs and appreciate that practice is unique for each teacher with each class" (p. 29).

Teachers are adult learners and have similar learning styles and needs as student learners. Flannagan and Kelly (2009) state that the goal of professional developers should be to "move all teachers toward expertise in teaching" (p. 29), but should also recognize that all teachers, much like their students, do not move at the same pace. As a result, numerous researchers have called for professional development that would meet teachers' needs where they were and would move at a pace that would ensure success for each teacher (Brinkerhoff, 2006; Hixon & Buckenmeyer, 2009; Kopcha, 2010; Collinson, Kozina, Kate Lin, Ling, Matheson, Newcombe, & Zogla, 2009; Flannagan, & Kelly, 2009; Hew & Brush, 2007; Kesson & Henderson, 2010; Palak & Walls, 2009; Renfro & Grieshaber, 2009) Such a model already exists for student learning: differentiated instruction.

Differentiated Instruction as defined by Tomlinson (2001, 2003) is "a philosophy of teaching [that purports] that students learn best when their teachers effectively address variance in students' readiness levels, interests, and learning profile preferences. A key goal of differentiated instruction is maximizing the learning potential of each student" (Tomlinson, 2005, p. 263). As stated, the purpose of making learning meaningful for each student and giving them opportunity to connect the classroom learning in a personal

way, is to allow each student to reach their potential in regards to learning. The key word in differentiated classrooms is "flexibility." This term encompasses not only the lesson as the teacher plans to present it to the students, but also in what type of product or assignment will be utilized as the assessment piece to the instructional delivery.

Using the differentiated instruction framework, teachers are encouraged to take students' interests, readiness, and attitudes into consideration as they plan instruction. While there is no specific formula that teachers need to follow for differentiation (Tomlinson C. A., 2005), keeping these in focus will allow teachers to make each lesson connect with each student in some way. For example, instruction should not be presented using a direct teach model, followed by class practice and then individual practice. Instead, students can be grouped based on performance on objectives, interest in topics, or their readiness for a skill. In this environment, all students can be working to master classroom objectives, but they would be doing so at a pace that compliments what they already understand, what they are ready to work on, and what they find interesting in order to keep them engaged. The teacher in the first classroom is a "director" of knowledge, and in the second classroom, she becomes a "facilitator" of knowledge.

Tomlinson (2005), the leading authority in the area of differentiated instruction, has outlined three "cardinal principles of differentiation" (pg. 263): 1) Teachers must take into consideration the attitudes that students possess about themselves as learners as well as their attitudes about the content being studied. Building positive self-images as a learner in any (and all) subject areas is critical to student success (Tomlinson C., 2003); 2) Differentiation does not replace curriculum, it simply alters it to make it accessible to all. It should be used as an extension for those who need to take their learning farther,

but also as a scaffold for those who need help to achieve. Regardless of where a student begins, the goal of differentiation is to make sure the learning is engaging to all students, meeting them where they are, and taking them farther than traditional methods of instruction have been able to take them (Tomlinson, Kaplan, Renzulli, Purcell, Leppien, & Burns, 2002); 3) Differentiation must be purposeful, not assigned based on assumptions, feelings, or otherwise undocumented ideas. It must be developed for students by using data gathered from both formative and summative assessments. It should be adapted based on the tenets of differentiation, student readiness, interest, and learning profile. Differentiation should be flexible, even in the middle of a task, to change based on student needs (Earl, 2003; Tomlinson C., 1999; Tomlinson & McTighe, 2006).

Teachers and students learn in the same ways. If differentiation works for students, it would then make sense that the same can be used for adult learners, in particular, teachers in professional development. In an interview with the North American Journal of Psychology, Carol Ann Tomlinson was asked "as educators, what is our responsibility to create the supportive learning environment where all learners can be successful?" She responded, "I think most of us had that moment of time when we entered teaching when we thought we were going to make a difference for human beings. I try to remember that we teach individuals" (Wells & Shaughnessy, 2010, pg. 646). Interestingly, her response did not discuss merely students in schools, but all human beings. Kesson and Henderson (2010), propose that professional development be differentiated for teachers:

> What distinguishes our approach from more mainstream approaches to professional development is that educators define their own learning needs, in the

> broad but specific context of becoming more adept at developing students' integrated Subject matter, Self, and Social knowledge (3S Learning) (pg. 225).

Making professional development meaningful for teachers is important in implementing long-lasting reforms to positively affect student achievement.

As student learning styles, background understanding, and ability should be taken into account when teachers are planning effective instruction, teachers, as adult learners, are no different. Each comes to a professional development opportunity with different skill sets, interest in the topic, and needs for developing. Flanagan and Kelly (2009) propose what they refer to as "responsive professional development," in which

> principals must recognize that all teachers do not have the same skill set with regard to content knowledge and pedagogy. Just as teachers respond to the varying needs of the students, professional development should do the same for teachers. To support teachers, principals must make plan and design effective professional learning opportunities to meet the varying teacher needs (p. 28).

One school district, Dysart Unified School District in Surprise, Arizona, has taken the differentiated instruction and applied it to professional development for its teachers. The goal is to support "teachers through differentiated, job-embedded professional learning, using specific feedback as the vehicle to impact classroom instruction…The payoff is increased student learning as an outcome of reducing the gaps between what we know and what we do" (Renfro & Grieshaber, 2009, pg. 27). After four years of differentiating its teacher trainings, Dysart began to see positive changes in the way students were learning and teachers were teaching. This type of focused, individualized learning is the purpose of differentiated professional development.

Technology Professional Development

Typical technology professional development tends to follow the same format as any other professional development for educators. These sit-and-get training sessions that provide minimal to no follow-up support are detrimental to the ability of teachers to be successful in technology integration especially given that it takes longer for teachers to be able to acquire new technology skills (Franklin, Turner, Kariuki, and Duran, 2002). Martin, Strother, Beglau, Bates, Reitzes, and Culp (2010) report that in their research findings of effective technology trainings, "programs with a minimum of 14 hours of professional development led to positive and significant effects on student achievement" (pg. 56). This is a far cry from the normal one hour to one day training typically offered.

Additionally, trainings related to technology integration do not usually take teachers' interest level or ability into account. Hixon and Buckenmeyer (2009) state that, "all teachers are expected to attend technology training, regardless of their readiness and/or interest in the topic. The training sessions are usually based on a 'one-size-fits-all' model where individual differences and learning styles are not taken into consideration…In general, teacher technology training tends to be 'just in case' instead of 'just in time'" (pg. 141-142), meaning that training is provided in case teachers ever decide to use it, rather than providing support as the teachers actually use the technology.

In addition to being timely and need based, technology professional development needs to also take into consideration ability levels and interest of teachers in order to be most effective. According to Ham (2010) teachers that have more access to training that meets their individual needs, the greater their success of implementation.

Finally, professional development opportunities must provide follow-up support following the training to assist teachers when they attempt to integrate their new learning. Mouza (2002) found that traditional professional development models do not provide any follow-up after the training and are ineffective in helping teachers implement technology into the classroom. The follow-up support is a critical component in helping teachers build a support system that will assist them as they gain confidence with technology integration.

Differentiated Professional Development

Because the potential of technology experiences can foster student achievement, and because teachers need to have high-quality professional development, especially related to learning the technologies, research in the field is still needed. Despite the growing body of professional development opportunities related to technology, a large amount of technology is still being used for teacher clerical activities instead of for student achievement (Yildirim & Kiraz, 1999). Numerous researchers have made calls for research into areas of technology usage. Liu & Szabo (2009) call for "specific steps in technology implementation [to] be addressed in schools in order to tap into the different technology user group needs (pg. 18). Hew & Brush (2007) desire for "effective professional development related to technology integration" to be "(a) focuse[d] on content…(b) give teachers opportunities for 'hands-on" work, and (c) [be] highly consistent with teachers' needs" (pg. 238). Brinkerhoff (2006) indicates that professional developers should "center instruction around participants' teaching interests, using hands-on activities and products…hold participants accountable for creating realistic lesson plans based on their technology integration ideas [and] hold participants

accountable for implementation of their integration ideas" (pg. 40). Each of these calls can be fulfilled through the use of differentiated professional development opportunities. Using this model with technology integration will help to alleviate the issue of teachers needing more time to be able to internalize the content in order to be able to successfully incorporate it into their classrooms because the professional development time will be more productive for each teacher. It will also assist in helping to raise teachers affect and aptitude for technology in such a way that they will be more willing to spend more of their planning time in exploring different ways to incorporate technology into their lessons.

Differentiated professional development opportunities for technology will also help to alleviate some, if not all, of the barriers to technology integration. When teachers are able to identify their needs and interests related to technology, they are more likely to use their time to study and learn that technology. As a teacher begins to master various technologies, his or her affect will increase, creating more desire to work toward mastering additional ways to integrate the technology into their classroom. Because support is embedded into the differentiated professional development, teachers will have the resources for assistance as they implement technology. When more teachers are utilizing differentiated professional development for technology integration, the school culture will begin to change as they seek out resources from each other. All in all, with a simple change of professional development strategies, a school will enable teachers to learn technology based upon their interests, skill levels, and needs, which will help to ensure a greater, and longer, implementation for students.

Conclusion

Research clearly identifies effective professional development as a necessary component to proper technology integration by teachers. Traditional professional development models have not been successful in helping teachers overcome difficult barriers to technology integration. It is necessary, then, to find a professional development model that will support teachers in their implementation of technology. In Chapter Three, a description is provided that outlines this study that intends to identify whether a professional development model with a differentiated approach for mentoring and follow-up training, will assist teachers in overcoming natural barriers to technology integration.

CHAPTER THREE

Methodology

The purpose of this research design was to determine whether a differentiated professional development model could make an impact on student-centered technology integration. By utilizing a small group of participants, this study was designed to explore barriers to technology integration and determine possible ways to overcome them. Results from this study could provide ideas that would benefit school leaders as they formulate the best approaches for effective professional development that meet the needs of the teachers. In this chapter the following components of the study will be presented: (1) Research Questions, (2) Research Design, (3) Data Collection, (4) Data Analysis, and (5) Reliability and Validity.

Research Questions

This study was designed to determine whether a differentiated professional development model will increase teachers' abilities and desires to incorporate technology into their lessons in more student-centered ways. To provide focus, the following research questions were adopted:

1. How does a differentiated professional development model impact teachers' implementation of "student-centered technology" integration?
2. How does a differentiated professional development model impact the ability of teachers to overcome natural barriers to technology integration?
3. How does a professional development model with a structured mentoring plan impact teacher's growth in regards to uses of student-centered technology integration?

Research Design

Analysis was conducted using the Case Study Method. Yin (2009) states that "case studies are the preferred method when (a) 'how' or 'why' questions are being posed, (b) the investigator has little control over events, and (c) the focus is on a contemporary phenomenon within a real-life context" (pg. 2). Merriam (1998) adds, "a case study design is employed to gain an in-depth understanding of the situation and meaning for those involved" (p. 19). Since the focus of this study was to determine how a differentiated professional development model impacts teachers in regards to technology integration, a case study methodology is appropriate. Using this design allowed the researcher to study the experiences of the study participants while involved in a differentiated professional development model. The in-depth study of the three teacher participants allowed the researcher to specifically understand the barriers to technology integration, how teachers attempt to overcome them, and how their perceptions of the process may or may not change.

The case study method allowed the researcher to treat each teacher as a separate case in order to fully understand the process, feelings, understandings, and struggles that each of the three teachers faced when involved in their own individualized professional development plan. This opportunity to study each participant separately also allowed the researcher to draw conclusions when comparing each of the cases to each other, thereby making generalizations that can impact how others view future professional development in relation to technology integration.

In order to answer the above research questions, each of the research questions have been linked to a collection method and the type of data that the researcher expected

each question to yield (Table 1). This table assisted the researcher in making certain that appropriate data is collected in order to answer the research questions.

Table 1
Research Question Connection to Methodology

Research Question	Collection Method	Collected Data
How does a differentiated professional development model impact teachers' implementation of "student-centered technology" integration?	Observation Interviews Artifacts Training Sessions	Anecdotal Notes Interview Protocol Blog Posts Anecdotal Notes
How does a differentiated professional development model impact the ability of teachers to overcome natural barriers to technology integration?	Observations Interviews Training Sessions	Anecdotal Notes Interview Protocol Anecdotal Notes
How does a professional development model with a structured mentoring plan, impact teacher's growth in regards to uses of student-centered technology integration?	Observations Interviews Artifacts Training Sessions	Anecdotal Notes Interview Protocol Blog Posts Training Sessions

Population and Sample

The population includes teachers in an urban middle school (7th and 8th grade) in Texas, USA. Teachers were asked to grant permission to participate by signing the consent form (Appendix A). Those that agreed to participate were given the "Massachusetts Technology Self-Assessment Tool" (Massachusetts Department of Elementary and Secondary Education, 2013) (Appendix B). This self-assessment helped to determine where teachers fell within four levels of technology proficiency: Early Technology, Developing Technology, Proficient, or Advanced. For the purpose of this study, only teachers that fell into either Developing Technology or Proficient were identified as potential sample members because teachers that fell within these two categories are typically less resistant to technology use. These teachers may struggle with overcoming barriers on their own and thus could benefit the most from the training

provided within the context of this study. Teachers in the Early Technology stage typically have fears that may keep them from making noticeable progress within the short time frame of this study. Those that fell within the Advanced category have already shown a propensity to overcome barriers on their own, whether from former training, interests, or ability with technology and may not show noticeable progress during the study. It was determined, then, that teachers falling within the Developing Technology and Proficient categories would be able to receive the most benefit and have noticeable growth within the time frame of this study. Other requirements for teachers to be considered as a potential participants include being a content area teacher (Mathematics, English Language Arts, Science, or Social Studies) and being in at least their third year of teaching. Those in core content areas would see student achievement change more readily than non-core subject areas. Teachers with fewer than three years of teaching experience were excluded because of their inexperience. It would be unrealistic to expect the to dedicate themselves to this study while still trying to understand their role as a new teacher.

Once a population of teachers that fit within the Developing Technology and Proficient categories and meet the content and years of teaching criteria was determined, three were selected randomly to receive a differentiated professional development program that followed Kopcha's (2010) framework previously discussed in Chapter Two. The remainder of the staff continued technology training in a traditional manner.

Needs Assessment

The needs analysis was taken from the Massachusetts Technology Self-Assessment Tool (Massachusetts Department of Elementary and Secondary Education,

2013) (Appendix B). The instrument is divided into three separate strands of questions within each of the four mastery levels (Early Technology, Developing Technology, Proficient, and Advanced). These three strands include: Technology Operations and Concepts, Ethics and Safety, and Teaching and Learning with Technology. The researcher utilized the self-reported data from the Teaching and Learning with Technology section as the needs analysis because this will be the same data that will be observable in the classroom.

The TSAT is a series of statements about technology ability. Each of the four levels and strands has a column next to them titled "I Know How To" for teachers to check those skills that they feel they can accomplish. Instructions on the TSAT state that though teachers may not be able to complete all the tasks, they should answer as honestly as possible. The first mastery level, Early Technology, has very basic skills of technology use, such as creating an email, explaining the purpose of an acceptable use policy, and using a word processor to create documents that support teaching and learning. Each of the subsequent mastery levels increases in technology difficulty.

The TSAT was used to help inform the researcher and the teacher of the teachers' interests and barriers as the two work together to develop an individualized professional development plan to address those interests and barriers. The researcher also used the TSAT as the basis for all data analysis. He connected the interview data, classroom observation data, and personal knowledge of the teacher as their instructional specialist, to the items that teachers checked that they could accomplish on the TSAT. This assessment helped give the researcher and the teacher a clearer picture of the teachers' perceived abilities, claimed abilities, and their actual performance in the act of teaching.

Participation in Study Presentation

In order to present the study to the staff, the researcher gained permission to use an already scheduled technology meeting to introduce the study and to get Informed Consent forms signed by those willing to participate. For the presentation, the researcher uploaded the Informed Consent document in a Portable Document Format (PDF) to the Adamsapp webtool (allows embedded media into a PDF file). The researcher used the hotspot feature to highlight the important pieces of information from each paragraph. These acted as talking points throughout the presentation. These talking points included the title and purpose of the study, what data would be collected, and what each participating teachers would be asked to do within the context of the study. The researcher also emphasized that there would be no risks involved in participation or penalty for non-participation and that the participants were free to leave the study at any time. Additionally, all contact information was given to the teachers for the researcher, the dissertation chairperson, and the chairperson of the Committee for the Protection of Human Subjects in Research for the University.

The presentation of the study was conducted during a regularly scheduled technology training called Technology Tuesdays. During this time, the Instructional Specialists shared new technologies with the entire staff, giving them resources and suggestions for classroom applications. As teachers entered the Technology Tuesday training room, they signed-in, picked up an Informed Consent form and had a snack. Immediately following the presentation of the study, teachers were asked to fill out the Informed Consent forms, which were then collected. If the teacher checked “yes” they would participate, they were then given the Technology Self-Assessment Tool (TSAT) to

fill out immediately. Teachers that checked "no" were dismissed from the rest of the meeting. A few participants selected that they would like to participate but were unable to stay and complete the TSAT right then. For these teachers, the researcher wrote their name on the front of their TSAT and asked them to meet with the researcher the next day to complete the form. All teachers that made this arrangement did come to complete the form over the next few days. When teachers finished completing the TSAT they were dismissed from the meeting.

At the conclusion of the meeting, all of the Informed Consent forms were signed by the researcher, whether they said yes or no, and then Xeroxed. Each copy of the Informed Consent was then put into an envelope with the teachers' name and placed in their box in the teachers' lounge (per the Informed Consent letter). The originals are kept in the researcher's office in a locked filing cabinet, separated into yes's and no's. They were pulled out when data analysis was being done on the TSAT's, and again to ensure that each instrument analyzed had an Informed Consent on hand that showed that participant agreed to be in the study. Also kept in the file are the completed TSAT's as well as blank copies not used of both the TSAT and Informed Consent. The Informed Consent presentation (using Adamsapp) was saved on a password protected flash drive.

Out of a staff of 40 teachers, 31 attended the meeting. The researcher talked with three of the teachers who missed the meeting over the course of the next few days to present the same material to them. The same presentation was used for each individual meeting as in the original meeting. Of the other six teachers who missed the meeting, one was an orchestra teacher (not a content area), and two were full time P.E. teachers/coaches (not content area). The final three were half-time coaches and half-time

content area teachers (ELAR, Science, and ELAR/SS). Given their half-time status as coaches, a decision was made to not pursue them as participants for the study because of the time required to meet with the researcher (coaches spend their conference period preparing for their athletic period or cleaning up from it). This necessity would make it difficult to use that time as training time. Another consideration is that athletics is either before or after school, making training difficult as well).

Of the 33 teachers that heard the study presentation, 19 agreed to participate and 14 declined. Of the 19, five were not considered because they did not meet the core content requirement (art, two technology, two life skills). Another teacher was eliminated because he was in his first year of teaching, leaving a possible pool of 13 before analysis was done on the TSAT information.

Selection of Participants

Before analyzing any of the TSAT instruments, the researcher made certain that each TSAT collected had an Informed Consent form to participate. To accomplish this, the researcher wrote the last name of the teacher on the front of their instrument (this was provided on the Demographic page) and then matched up the TSAT with an Informed Consent form.

Next, the researcher printed off the criteria given by the Massachusetts Department of Elementary and Secondary Education for each of the categories: Early Technology, Developing Technology, Proficient, and Advanced (www.doe.mass.edu/edtech/standards/sa_tool.html). The sample Microsoft Excel file (Appendix C) shows how many questions each teacher stated that they could do in each

area and then calculated the status of mastery for each teacher (far right column in Appendix C).

The percentages provided from the Massachusetts Department of Elementary and Secondary Education (2013) is included in Table 2. The researcher set up formulas in Excel to determine whether the participant met the requirements for that area. These requirements were taken from the TSAT guidelines. They indicate the percentage that must be completed in each area in order to advance to the next level. Table 2 shows the percentages required to master each of the levels of the TSAT (Massachusetts Department of Elementary and Secondary Education, 2013).

Table 2
TSAT Mastery Levels

TSAT Level	Technology Operations & Concepts	Ethics & Safety	Teaching & Learning with Technology
Early Technology	100%	100%	100%
Developing Technology	80%	100%	80%
Proficient	80%	100%	80%
Advanced	80%	100%	80%

The researcher created an "if-then" calculation that determined the status into which each teacher would fall. For instance, in order to be considered Developing, Mr. Brown (sample teacher) would have to have 100% in Technology Operations and Concepts, 100% in Ethics and Safety, and 100% in Teaching and Learning with Technology. Because he failed to reach 100% in the Ethics and Safety category, the program correctly identified him as in the Early Technology group. The 10 in the score column for Ethics and Safety indicates that Mr. Brown was unable to be classified as Developing because of missing one out of eleven questions in the Ethics and Safety

category. Sample questions in this category include explaining school acceptable use policy, follow appropriate licensing and documentation for software, and evaluating the proper physical setup for technology in a classroom.

Mrs. Duncan (another sample teacher), on the other hand, met all requirements in order to be correctly identified in the Developing group. In order to complete the information, the researcher filled the score column with the number of questions in each category that each teacher checked that they were able to complete.

After entering the data, it was determined that only one teacher was categorized as Developing, while two were Advanced. The other 10 were all classified as Early Technology. This presented a problem because, according to the study requirements, participants needed to fall into either the Developing or Proficient categories.

The researcher began to examine the questions that might have caused participants' score to not be designated as the Developing category. This could have been for a number of questions that related to all three levels of the TSAT (Technology Operations and Concepts, Ethics and Safety, and Teaching and Learning with Technology). Each person's scores were combined and tallied on a blank TSAT document to see if there were patterns to the questions that teachers were not checking as things they could do in regards to technology. A breakdown of the questions that were questionable can be found in Appendix D.

After looking at these results, the researcher decided to eliminate two questions: question four pertaining to Universal Design for Learning (UDL), and eleven related to current research because the most respondents were unable to accomplish them. It was determined that the terminology of UDL is not discussed in classrooms where assistive

technology is unneeded and teachers can effectively integrate technology without being able to discuss the most cutting edge research about them.

Throwing out those two questions yielded an additional four possible participants, but one of those had to be removed because the teacher was going on maternity leave and would not be able to complete the study. At this point, there were only four possible teachers from which to randomly select three participants for the study.

Because there were only four teachers that met all the study criteria, the researcher decided to look back over the TSAT results to see if there were any other teachers that might have missed the Developing category by one question. If so, an analysis of the particular question that kept them from Developing might result in reasons to disallow the question and add more teachers to the pool of potential participants. The researcher found that four were missing Developing by one question. TSAT questions and discussion that were considered for elimination can be found in Appendix E.

Upon completion of the analysis of the TSAT's, a pool of six potential participants was left. The researcher put their names in alphabetical order and then assigned each name a number from one to six. The researcher used www.random.org to generate random numbers from 1-6. The numbers generated came out in this order: four, one, and six. This provided the study participants: Mrs. Faye Cummings, Mrs. Donna Clayton, and Mrs. Ann Evans (all pseudonyms are based on the confidentiality agreement in Informed Consent to Participate).

Protection of Human Subjects

In order to ensure confidentiality, the names were coded so only the researcher had access to identities. District, school, and teacher identification will remain coded and will be used in any presentation of results.

Interviews were audio recorded for later transcription and use. Any use of the audio was conducted as discretely as possible so as to protect the confidentiality of participants. Audio recordings will not be used as part of any presentation of results.

Researcher Role

Within the confines of the study, the researcher acted in part as the traditional professional development provider for the entire staff while working with the three participants involved in the differentiated professional development model separately. During the course of the study, the researcher provided each participant with individualized training, based on his or her needs and interests and support during implementation of technology. This support was instigated by each participant and could be scheduled in advance or requested as soon as an issue became apparent during implementation. The support consisted in any issue that would assist the teacher in continuing with his or her integration of technology. Examples of support include troubleshooting technology issues, assisting in planning for a lesson with technology, teaching a mini-lesson to students on how to use the technology, or observing in order to give feedback to the teacher.

Data Collection

The following items were collected for data analysis: interviews, observations, individualized professional development plans, lesson plans, technology request forms,

email requests for assistance, blog posts, anecdotal notes, just-in-time training logs, and training plans. Some of the data pieces are researcher created and some are teacher created. For example, the researcher developed an interview protocol to use during interviews while the teacher created lesson plans that he or she wrote for their classes. Each of the items used for data analysis was collected to answer the research questions of this study. All items are explained in greater detail below.

Interviews

Two sets of formal interviews were conducted, the first at the beginning of the study and the second at the conclusion of the study, each lasting approximately forty-five minutes. Merriam (1998) states that, "interviewing is necessary when we cannot observe behavior, feelings, or how people interpret the world around them" (p. 72). Since technology integration is a construct that deals with individual teacher understanding about technology use in the classroom, it is necessary to conduct interviews with participants. Data from these interviews assisted the researcher in interpreting how the participants feel and understand technology integration. It was intended that both the initial interview (Appendix F) and final interview (Appendix G) protocols be semi-structured, meaning that there were written questions, but the "interviewer decides sequence and wording of questions in the course of the interview" (Teddlie & Tashakkori, 2009, p. 229). Merriam (1998) states that semi-structured questions "are more flexibly worded, or the interview is a mix of more and less structured questions" (p. 74). Using this type of questioning, the researcher was able to collect common information from all three participants, but also had the freedom to explore topics important to the participants. Questions related to the use of the technology were adapted

from the Teacher Technology Use Questionnaire by Cifuentes, Maxwell, & Bulu (2011, pp. 68-69).

A third, less-formal interview was conducted approximately one year after the completion of the study in order to determine whether the study had long-term effects on the teachers' ability to integrate student-centered technology. This interview was conducted via email and included a short list of questions (Appendix H). These questions all related to the sustainability of the participants' technology uses after the study concluded.

Observations

The researcher conducted two observations at the beginning of the study, each lasting a minimum of thirty minutes. In addition, the researcher observed and recorded notes as to the uses of the technology and documented whether the technology was student-centered or teacher-centered. Any ideas, or suggestions, that the researcher reflected on during the lessons for possible areas of technology integration were recorded. During these two observations only, the researcher served in an etic role (Creswell, 2007; Merriam, 1998), meaning that the researcher did not make himself available for assistance with technology or advice so that he could get a clear picture of the progress, or lack thereof, being made by the teacher in integrating technology. Instead, he was simply an outsider observer for those two observations, doing his best to remain unnoticed so as to be able to observe the class as objectively as possible. During other parts of the study, the researcher was an active participant in the research.

Individualized Professional Development Plans

Two Individualized Professional Development Plans were written within the course of this study. These plans were prepared by the researcher and the teacher side-by-side and were informed by their TSAT data, interview analysis, classroom observations, as well as interests and abilities of the teacher. The researcher used a protocol for writing an individualized plan (Appendix I). This protocol was a semi-scripted agenda for the meeting. This means that the researcher typed out what he intended to say in the introduction and listed steps for creating the Individualized Professional Development Plan in order to keep the meeting focused on the task.

The first plan was prepared when the TSAT, initial interview, and both classroom observations were completed and thoroughly analyzed. In the meeting to set up this training plan, attended by the researcher, Instructional Specialist, and teacher, the researcher provided what data was collected, how it was analyzed, and shared findings. Additionally, the major barriers found in research were explained and teachers were informed which of those barriers their data indicated they would need to overcome. Aspirations that were vocalized by the teacher during the initial interview were covered, as well as any support issues that the teacher mentioned. Finally, the researcher explained the Kopcha (2010) model that he planned to use during the training portion of the study. Once this information had been conveyed, the researcher, instructional specialist, and teacher created an Individualized Professional Development Plan designed to meet the teachers' needs. This plan focused on identifying one technology or type of technology for the teacher to work on mastering, as well as any possible barriers that would need to be addressed in order to implement that technology. The plan also

contained two thirty-minute training sessions per week. The trainings were scheduled at the teachers' convenience and were carried out over the course of six weeks. Each teacher received at least seven individualized training sessions. Because of conflicts related to state-mandated testing and end-of-school activities, only two of the three were able to meet for an eighth individualized training session. These trainings were intended to carry out the plan that was written by the researcher, Instructional Specialist, and teacher.

The second plan was to be written when the teacher has completed the first plan by completing all levels of Kopcha's (2010) model. The purpose of setting a second Individualized Professional Development Plan was to determine what technology the teacher would want to learn next. Analysis would be done to determine whether the first Individualized Professional Development Plan helped the teacher gain confidence with technology resulting in the teacher choosing a much more difficult or more student-centered technology to study during the second iteration of the model. If the teacher had completed the first Individualized Professional Development Plan before the study concluded, the second plan would be implemented. If the first plan was not completed before the end of the study, the second plan was to be written in conjunction with the final interview and would not be implemented but would be for informational purposes only. Time frames on how long each plan took depended upon the plan that the researcher, Instructional Specialist, and teacher wrote, and how much training the teacher required in order to move through Kopcha's (2010) model. Failure to finish the plan within the framework of this study was not an indication of failure for the plan or teacher

in making progress toward technology integration, because each teacher moved through the steps at the pace that best suited their learning.

Teacher Artifacts

Identifying how teachers utilized technology within their everyday acts of teaching required the collection of data specific to the teacher and his or her classroom activities. These artifacts were collected in order to identify the uses of technology integration within their written lessons as well as other documentation that showed what struggles they face when they do integrate technology. These artifacts consisted of teacher lesson plans, technology request forms, email requests for assistance, and technology blog posts.

Lesson plans. Teacher lesson plans were collected during the course of the study in order to identify how the teachers planned for technology use. The lesson plans also assisted the researcher in knowing when the teacher planned technology in their lessons. These lesson plans also gave the researcher the ability to identify whether the teacher planned for teacher-centered or student-centered technology uses.

Technology request forms. Technology request forms were available for all staff to fill out for assistance with technology hardware or integration issues. Two separate forms were available, one for hardware issues and one for integration assistance. Both forms allowed the teacher to detail their request for help. These forms were available outside of the Instructional Specialist office and could be returned to the same location. For each participant in this study, these forms were collected to record assistance that they requested.

Email requests for assistance. In addition to the technology request form, any requests related to technology received by the researcher via email from a participant were collected. These requests were similar to the Technology Request Forms. Many teachers preferred to email requests for assistance.

Blog posts. Finally, teachers' posts on the school's technology blog were collected (Appendix J). The blog was set up in order to facilitate the sharing of technology ideas across the campus. Having a place to record questions, ideas, resources, and suggestions gave teachers an opportunity to collaborate in a technology setting. To help encourage the sharing of ideas, the school promoted a monthly contest on the blog called the "Brag Board Award." Teachers posted how they used technology in the classroom for others to see. The intent was to encourage teachers to share technology integration ideas and discuss how they were using the technology that was being trained during their traditional professional development opportunities. At the end of each month, the most creative uses of technology were awarded prizes that consisted of gift cards to local restaurants and other stores. Awards were given during Technology Tuesday meetings.

During the course of this study, the monthly blog post contests continued, giving the researcher the opportunity to collect the blog posts that show, in the teacher's own words, how she was implementing technology and what she understood about student-centered technology versus teacher-centered technology integration.

Researcher Artifacts

In addition to teacher artifacts, the researcher collected other artifacts throughout the study. Utilizing researcher artifacts assisted the researcher in documenting his own journey as well as thoughts, trainings, and plans created in response to the teacher and his or her needs related to the study. These included anecdotal notes from training sessions, just-in-time training logs, and training plans written by the researcher from the plan co-created by the researcher and each participant.

Anecdotal notes. The researcher kept anecdotal notes of information collected during the training sessions with each of the participants. These notes detailed how the teacher was doing with previously received lessons, issues explored, and discussions, specific training implemented, questions from the participants, and items planned for the next training session.

Just-in-time training logs. Participants in this study had the ability to call the researcher or the Instructional Specialist for any issue related to technology and receive immediate attention to assist in removing the current problems that the participant may have been experiencing while integrating technology. These requests were not the same as the Technology Request Forms or the email requests discussed above. Rather, these "just-in-time" requests meant that a participant could call, text, email, send a student, or any other means necessary to get the researcher or the Instructional Specialist to come immediately for technology assistance. The purpose of this was to increase the teachers' confidence in trying new technologies. In order to document these just-in-time training

requests, a log was kept to describe when the request was made, what the request was, and how it was resolved.

Training plans. Finally, training plans were written each week by the researcher. These plans were based on the original plans co-written by the researcher and each participant, and gave a focus to each one of the trainings. The plans included resources and activities that may assist the participant in what they were currently trying to master. The researcher wrote these plans weekly, following both of the training opportunities with each participant in order to create plans that mirror the needs, desires, and wants of each participant. A brief description of the training plans for each participant can be found in Appendix K.

Data Analysis

Because the intent of the study was to document whether the model impacted the teacher's ability to overcome barriers, a case study methodology was used for analysis. This included detailed written description of the experiences of each teacher as they proceeded through Kopcha's (2010) model for technology integration. The researcher documented a case study for each research participant detailing his or her experience with the differentiated professional development. The cases present a story of how each teacher moved through the stages of Kopcha's (2010) system-based approach to technology integration.

Each case was coded for themes that emerge from each piece of data. These themes were used to compare across the cases to see if common themes existed. Creswell (2007) explains that, when using a case study methodology, "the researcher

establishes patterns and looks for a correspondence between two or more categories" (p. 163). The themes and patterns that emerged from the data were used to inform teacher leaders and those in charge of professional development opportunities of the impact of a differentiated professional development model, specifically for the integration of student-centered technology.

Qualitative Analysis – Observation

Classroom observations were conducted by using the constant comparative method to identify common themes throughout the observations. These included looking for any patterns emerging from what was observed during each of the two classroom observations related to technology integration. Analytic induction was used to see if the themes held up when compared to each of the other case studies. When using analytic induction, the researcher looked at each case separately to determine patterns, and then compared those patterns to all three cases as a whole to see if the results were discovered in all three cases. According to Merriam (1998), "while analytic induction in its most rigorous form is not often employed in qualitative research, the idea of testing tentative explanations (or hypotheses) in ongoing data collection is used" (p. 161).

Qualitative Analysis – Interview

Interviews were analyzed by using the constant comparative method to identify common themes throughout the interviews. This included searching for patterns that emerged from the answers that the teacher gave in response to questions as well as the choices that the teacher made for their individualized professional development plan.

Analytic induction was used to see if the themes held up when compared to each of the other case studies.

Analysis Tools

Analysis tools were used to analyze the data collected during the course of the study. These tools were developed by the researcher to assist in gathering and coding the collected data. These include three main types of tools: triangulation analysis, assistive data and evaluative data. All three types were critical to the data analysis process and are discussed in more detail below.

Triangulation analysis. The researcher created an analysis spreadsheet in order to analyze the TSAT information, the initial interviews and the classroom observations so that an individualized professional development plan could be written. In addition to this information, the researcher also included information that he already knew about the teacher because of his role as their Instructional Specialist. There could be TSAT information that could be verified by what the researcher had already observed while working with the teacher in that capacity.

Because the TSAT data comes from self-reported data, the researcher searched in the initial interview transcripts, both classroom observations, and what the researcher knew about the teacher from being their Instructional Specialist, and attempted to find evidence that would verify what the teacher self-reported on the TSAT. In order to organize all pieces of information, the researcher created a spreadsheet with columns for each of the data pieces and rows that indicated the TSAT statements and codes. The researcher also included a column to note whether the teacher reported that they were

able to accomplish that facet of technology that was addressed in the TSAT statement. Direct quotes from the initial interview that related to that TSAT statement were pulled from the interviews to show proof of TSAT statements. If there were multiple quotes that verify that the teacher was able to accomplish that task, they were included. In the column for observations, the researcher indicated if there was any evidence of that TSAT statement during either of the interviews conducted in the teacher's classroom. The final column was set-aside for the researcher to note any information that he already knew about the teacher through his role as Instructional Specialist that corresponded to that TSAT statement.

One last piece of this spreadsheet included specific statements that were made by the teacher during their initial interview that related to their own barriers, aspirations, and support needed in order to utilize technology in their classrooms. This section of the document was populated with direct quotes from each teacher and was used to help guide the researcher in suggesting possible areas of study during the development of each of the teachers' Individualized Professional Development Plan.

The triangulation spreadsheet was analyzed by searching for themes that emerged from comparing the data from each piece of data. Common themes were pulled out and put on the agenda for discussion with the teacher prior to setting up their first Individualized Professional Development Plan.

Assistive data. These data sets were collected and analyzed in order to determine what type of assistance was needed and/or requested by the teacher. These included the first Individual Professional Development Plan, all researcher field notes, just-in-time logs, researcher training plans, and any tech requests made by each participant.

After the initial interview with the teacher, the researcher analyzed the interview data, classroom observation data, and the self-reporting information from the TSAT and, together with the teacher, developed the first Individualized Professional Development Plan. This plan was created in the meeting between the researcher, Instructional Specialist, and each participant and was formulated from the discussion about the triangulation analysis. It was analyzed to see the type of technology that the teacher had an interest in studying more in-depth. It was also analyzed to see what barriers and support the teacher felt they needed in order to master that new technology.

The researcher's field notes were analyzed to look for progress made throughout the six-week training process. These allowed the researcher to determine how much progress was made, what questions the teacher's had during training, what the teacher wanted to focus on during the training and what issues the teacher and researcher worked through during training sessions. This information was used to determining how a teacher was progressing through the Kopcha model.

A log was kept of just-in-time requests that were received from each participant. These logs were analyzed to see what type of assistance was needed and whether or not these requests showed progress through Kopcha's model. The logs contained the requesting teacher's name, what specific request each teacher had and what the researcher did to alleviate the issue so that the teacher could continue utilizing the technology as seamlessly as possible.

The researcher wrote lesson plans each week based on his field notes, and these also assisted in determining how a teacher was moving through the model. These plans

helped the researcher look for themes that might be emerging around the training being provided to the teachers.

Finally, technology requests made with the Technology Request form or through email or verbal requests were analyzed to determine whether these requests showed progress through Kopcha's model. Additionally, these technology request forms were analyzed for evidence of a shift from teacher assistive to student-centered technology use.

Evaluative data. These data sets were collected and analyzed in order to determine whether teachers was making progress through the Kopcha model and whether they were making the shift from teacher assistive to student-centered uses of technology. These data sets included the final interview and the second Individualized Professional Development Plan.

Because the questions were the same as the initial interview (except for a few more added to the final interview) the final interview was compared to the initial interview to determine whether there were patterns of growth in the participant's understanding and beliefs about teacher assistive versus student-centered uses of technology. The researcher updated the triangulation spreadsheet to include a new column that contained the responses given in the final interview. This helped to determine whether there was additional evidence for the TSAT statements that the teacher checked prior to the beginning of the study. The researcher created a separate spreadsheet that included the side-by-side answers of the initial and final interviews. The researcher searched for themes running through the two interviews and looked for evidence of growth through Kopcha's model and from teacher assistive to student-centered technology uses.

The second Individualized Professional Development Plan was analyzed in order to determine whether the teacher had increased his or her confidence in selecting technology to integrate in the classroom. The researcher searched for evidence that showed the teachers making decisions on technology use that was previously inhibited by barriers that they faced. The second Individualized Professional Development Plan was analyzed in this manner even if it was created at the end of the study during the final interview process. Should the teacher have moved more rapidly through Kopcha's steps and created and completed the second Individualized Professional Development Plan, a third and any subsequent plans created during or at the end of the study would have been analyzed just as described above.

Long-term data. Following the study, the researcher wanted to see any long-term benefits that might have occurred following the differentiated professional development given to each of the three participants. Because the researcher and one of the participants had moved to another position with another school, the interest was to see whether the results of the training allowed the teachers to continue to integrate the technology that they studied. One year after the conclusion of the study the researcher provided the participants with open-ended questions via email and then looked for themes to emerge and evidence to support whether the teachers were making progress through Kopcha's model and were moving from teacher assistive to student-centered uses of technology.

Connection to Research Questions

The purpose of each data collection method was to be able to answer each of the three research questions that frame this study. Each question and its data collection are addressed below.

How does a differentiated professional development model impact teachers' implementation of "student-centered technology" integration? Through observations the researcher looked for evidence of the teacher being able to integrate the technology that was being addressed through the differentiated professional development. Observations of student-centered technology were notated in the notes taken during the observation.

During interviews the researcher listened for indications, language, and statements that would indicate a teacher is making progress toward an understanding of technology integration. Also, over the course of the cycle of interviews, initial, final, and follow-up, teachers who were progressing in their understanding and implementation of student-centered technology integration indicated that in their answers and language that they use to answers the questions.

Additionally, several forms of artifacts collected throughout the study assisted in answering this research questions. Teachers that posted on the school technology blog would have examples of their uses of technology in their classrooms. Individualized Professional Development Plans were also analyzed from the first to the second to see if teacher's ambitions toward learning new technologies were becoming more student-centered. Training notes contained evidence of teacher's growth toward this research question as well.

How does a differentiated professional development model impact the ability of teachers to overcome natural barriers to technology integration? Observations showed whether teachers were overcoming the natural barriers that they had discussed in their interviews and training sessions. Through classroom observations, the researcher was able to see firsthand how these barriers affected the teachers' ability to integrate technology.

Analysis of the interviews revealed barriers discussed by each teacher. These interviews provided valuable information when creating the Individualized Professional Development Plans that would work specifically on helping the teacher to overcome those barriers. Longitudinally, there should be a change in barriers that teachers struggle with from the initial interview to the final interview.

Training sessions also gave clear indication of whether a teacher was overcoming barriers that were specifically being addressed as a result of the Individualized Professional Development Plan. These data showed how a teacher dealt with the particular barrier and whether or not the training being provided by the researcher assisted them in overcoming the barriers they each faced with regard to student-centered technology integration.

How does a professional development model with a structured mentoring plan, impact teacher's growth in regards to uses of student-centered technology integration? During observations, the researcher did not become involved in the classroom discourse at all. As a result, the researcher was not able to assist the teacher as a mentor. However, the observations served to provide evidence of areas that the teacher may need assistance in the future from the researcher.

Interview data assisted the researcher in determining areas of mentoring from which each teacher would benefit. The data indicated areas of concern for the teacher as well as any aspirations for technology integration that the teacher had for the study.

Teacher artifacts, such as blog posts and email requests for assistance, showed where the teacher needed assistance from a mentor. Looking at these artifacts indicated whether mentoring is helping, especially if the requests changed and were not for the same issue repeatedly.

The notes from training sessions provided important evidence to indicate whether the mentoring experience had been beneficial for the teacher. These training sessions were based upon teacher need and were facilitated on the premise of mentoring assistance. If the mentoring was working, the teachers' needs should have progressed through Kopcha's (2010) model.

Reliability and Validity

In order to preserve validity in the study, the researcher was able to make adjustments to protocols and instruments to fit the needs of the study. Member checks, triangulation of the data, addressing possible researcher bias, utilizing thick description to detail the process that the researcher went through, and reporting any findings that contradict developing themes all assisted in increasing internal validity (Gay, Mills, Airasian, 2006; Merriam, 1998).

The researcher utilized each of the methods listed to ensure he maintained internal validity for this study. Member checking included taking collected data back to the participants in order to have them verify that the results were accurate (Creswell & Plano Clark, 2011; Gay, Mills, Airasian, 2006; Harper & Cole, 2012; Merriam, 1998; Teddlie

& Tashakkori, 2009; Yin, 2009). The researcher used multiple sources in order to triangulate the collected data (Creswell & Plano Clark, 2011; Gay, Mills, Airasian, 2006; Merriam, 1998; Mertler & Charles, 2008; Teddlie & Tashakkori, 2009; Yin, 2009). The triangulation of data was accomplished by conducing within-case and cross-case analysis in order to identify whether themes that emerged within each case were common within all cases (Creswell, 2007; Merriam, 1998; Yin, 2009). Any possible bias held by the researcher was clarified (Bogdan & Biklan, 2007; Creswell & Plano Clark, 2011; Gay, Mills, Airasian, 2006; Merriam, 1998; Yin, 2009) and cases were described through thick, rich description (Merriam, 1998). Contradictory data that does not fit the themes that emerged from the data was included in the findings (Merriam, 1998).

In order to increase generalizability of the findings of this study, the researcher employed recommendations from research about external validity. First, the researcher studied several participants in multiple settings, by using classroom observations, interview sessions, and training sessions (Merriam, 1998; Yin, 2009). Second, rich, thick description was used to detail each participant's journey through the Kopcha (2010) model employed (Merriam, 1998; Yin, 2009). Finally, multiple cases were utilized in order to determine whether themes that emerged fit all cases studied (Merriam, 1998; Yin, 2009).

To ensure reliability of the findings, the researcher used a chain of evidence (Yin, 2009) so that an outside observer would be able to follow all the evidence related to the study. This chain of evidence included developing protocols used in interviews, classroom observation forms, detailed field notes, and a process of triangulation to analyze data.

Conclusion

Utilization of the case study method allowed the researcher the opportunity to examine more closely how teachers interacted within the differentiated professional development model. In Chapter Four, descriptions of each participant and their journey through the study will be discussed at length. By analyzing each case study, the researcher identified themes and explored from the data collected. These themes and patterns allowed the researcher to draw conclusions about how teachers were affected by the differentiated professional development model.

CHAPTER FOUR

Results

By following a case study methodology, the researcher collected pieces of data in order to create individualized professional development plans for each of the participating teachers. Using this methodology, the researcher treated each teacher as a separate case in which findings were collected. After each case, and its findings were considered separately, all three were considered together in order identify the themes that emerged from all three teachers. Findings from all three cases and themes that emerged from the three cases considered together are presented in this chapter. A timeline of events can be found in Appendix L. The following three research questions were used to maintain a focus throughout the data collection and analysis process:

1. How does a differentiated professional development model impact teachers' implementation of "student-centered technology" integration?
2. How does a differentiated professional development model impact the ability of teachers to overcome natural barriers to technology integration?
3. How does a professional development model with a structured mentoring plan impact teacher's growth in regards to uses of student-centered technology integration?

Collected Data

In an effort to answer the three research questions, the researcher collected several pieces of data during the course of this study. Collectively, these data helped the researcher to develop an understanding of the barriers, aspirations and needs of each of the participants in relation to student-centered technology integration. Figure 2 illustrates

how the data flows, helping the researcher make sense of what was collected and examined through the process of conducting the study. In the Figure, each bubble represents data collected and its' flow through the analysis process. Arrows indicate the direction that the data flowed through the study. Collected data on the same horizontal plane work together to inform the next piece of data/analysis that is directly below it in the chart. For example, setup of the classroom and IS knowledge both inform the observational data that was collected. Adding the observational data with the TSAT results and the initial interview, the triangulation data was created and analyzed.

Figure 2: Flow of Collected Data

Analysis

Collected data was analyzed using pattern-matching leading to a cross-case analysis. Yin (2009) indicated, "for case study analysis one of the most desirable techniques is to use a pattern-matching logic" (p. 137). By analyzing anticipated themes with actual themes that tended to emerge from the data, the researcher was able to create a profile of each teacher's journey through the study. Creswell (2009) calls this a within-case analysis, which would then be followed by a cross-case analysis that would allow an interpretation of the cases together.

Themes that emerged from the pattern-matching, or within-case analysis, included: aspirations, barriers, technology use, student-centered understanding, professional development goals, and follow-up support needs. Using these same themes, the researcher was able to conduct a cross-case analysis, which led to the findings of the three cases taken together. Figure 3 shows the analysis of data from within-case analysis, indicated by the bound cases, and cross-case analysis, indicated by the arrows.

Participants

The participants of the study were selected using a purposeful sampling procedure. The participants were required to have at least three years of experience in the classroom, be the teacher of a core content area (English, mathematics, social studies, or science), and not be assigned to coach a sport (time constraints on a coach would make it difficult to devote time to individual training with the researcher), and scored in either the Developing or Proficient category on the Massachusetts Technology Self-Assessment Tool (TSAT) (Massachusetts Department of Elementary and Secondary Education, 2010). Purposeful sampling was used to ensure that, as Merriam (1998) stated, "the

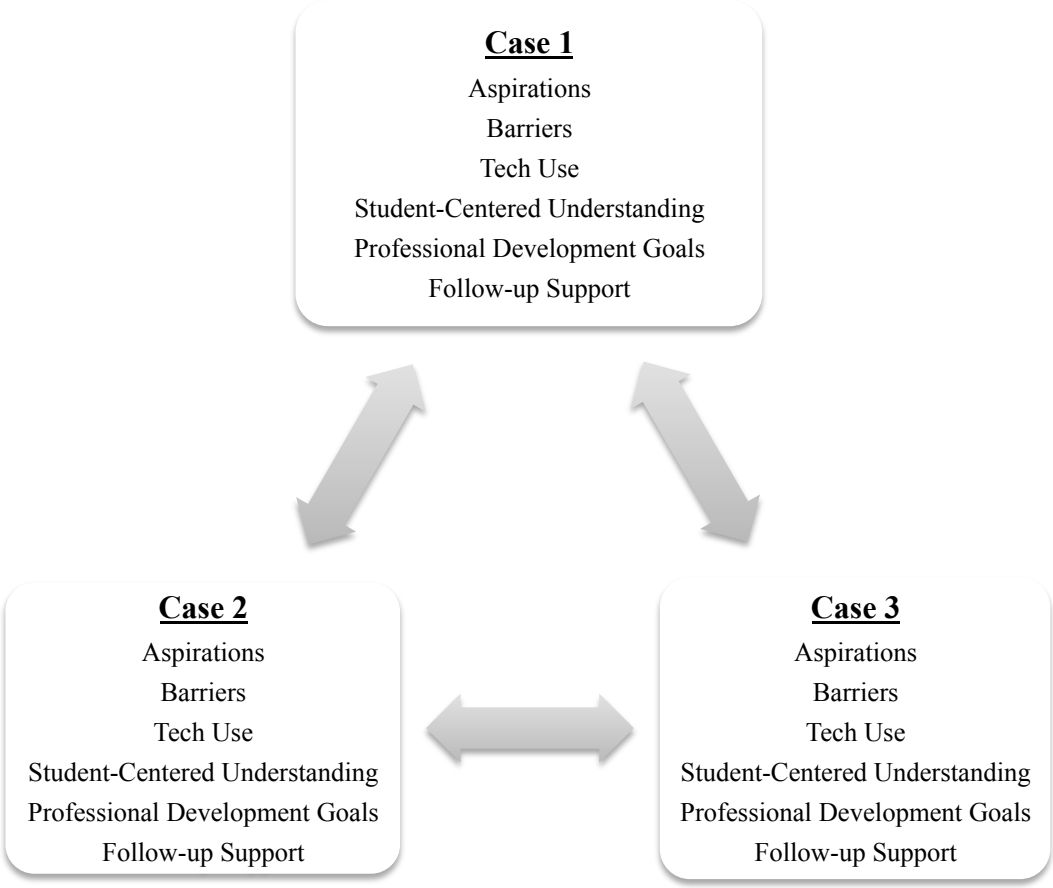

Figure 3: Analysis of Data

investigator wants to discover, understand, and gain insight and therefore must select a sample from which the most can be learned" (p. 61). Once a pool of potential participants was established, the researcher randomly selected three to participate in this study. Because the participants were taken from a pool of teachers that met the criteria, the three participants were typical cases for their campus.

The three selected participants selected represent a range of technology proficiency, even though all three met the Developing status as indicated in the section above. Faye Cummings (pseudonym used) teaches eighth grade mathematics and utilizes technology for teacher assistive purposes. Upon hearing of this study, she begged to be selected because she wanted to improve her ability to integrate technology into her

classroom. Mrs. Cummings struggles with classroom management and when absent from work technology often goes missing or is damaged. While she is in the classroom she frequently has difficulty gaining and maintaining student interest and focus on the lessons she was delivering.

Donna Clayton (pseudonym used) also teaches eighth grade mathematics and is considered by most of the staff to be the top technology integrator on campus. She is eager to learn new technologies in trainings. Mrs. Clayton does well with classroom management and has no issues with broken or misused technology while she is in the classroom or absent. She uses technology in various ways, such as recording herself teaching a lesson to play when she was absent.

Ann Evans (pseudonym used) teaches eighth grade science. She utilizes only the technology required by the principal, such as computer to take attendance, document camera and projector. Mrs. Evans reported that she is apprehensive about using technology because she does not understand it. She has good rapport with her students and classroom management is not an issue for Mrs. Evans.

All three teachers were willing to be part of the study and shared an interest in learning about integrating technology into their classrooms. Mrs. Cummings and Mrs. Clayton taught across the hall from each other and shared a common planning period, which allowed them to discuss teaching strategies if they desired. Mrs. Evans also taught eighth grade students and shared her students with both Mrs. Cummings and Mrs. Clayton but her classroom was in another hall and she did not have the same planning period. All three teachers shared a common lunchtime and frequently ate lunch in the

teachers' lounge together. An opportunity for collaboration and discussion about the technologies was available for all three participants during the course of this study.

Outline of Cases

Each case will begin with a brief introduction of the teacher, including a description of their technology use prior to beginning this study. Following the introductory section, the researcher will discuss each of the six themes that were identified and how they relate to the participant. These themes include aspirations with technology, barriers to technology integration, how the teacher used technology, progress toward student centered understanding, professional development needs, and follow-up support needs. After each is discussed, the researcher discusses each participant's conclusions for each of the six themes.

Case Study: Faye Cummings

Mrs. Cummings Introduced

Faye Cummings (pseudonym) was a Caucasian female in her forties. She had a total of five years teaching experience, four within the content of mathematics, and one in English Language Arts. Mrs. Cummings had been in her current teaching assignment, eighth grade mathematics, for three years and had taught four years in a middle school and one year in an elementary school. She generally presented content material to her students in lecture format with some small group activities. Her students relied heavily on her assistance when working independently and would oftentimes be off task while waiting for her to get to their questions.

Mrs. Cummings's classroom was set up in one major student section. This section consisted of several straight rows of student desks facing the front of the classroom, noted by the placement of the whiteboard. Even when prompted to work in groups or with a partner, students were instructed to stay within their area of the classroom, thus maintaining their rows. There were two long tables set up in the back of the room when some students needed to work together. Most often the tables were used to lay out materials for students to pick-up as they entered or return assignments when they left. Occasionally disruptive students were sent to the table to work independently.

While technology was being used in Mrs. Cummings's classroom, the main function was focused on teacher assistive technology. For example, she used a teacher laptop, projector, and document camera almost every day. These tools assisted her in presenting the content material to the students. She had an eInstruction® Interwrite™ Board in her classroom, but it was used to project the images from the computer and projector because the wall-mounted boards were stained, making it difficult for students to see an image from the projector. Additionally, Mrs. Cummings had a Mobi™ Board that she used as a wireless mouse. This tool allowed her to control her computer screen while walking around the classroom monitoring the students. She claimed that she occasionally allowed students to use the Mobi™ Board to work out problems on the whiteboard for the class.

Mrs. Cummings scored in the Early Technology category of the Technology Self-Assessment Tool (TSAT), missing the Developing category by just two statements. After careful consideration of the two statements, the researcher dropped the two from consideration based on their content (UDL and the ability to discuss research related to

technology). Because of this, Mrs. Cummings was moved up to the Developing category. Despite originally scoring in the lowest category, Mrs. Cummings exhibited a strong desire to learn how to better incorporate technology into her classroom. Several times, prior to participants being randomly selected, Mrs. Cummings expressed a desire to be selected as a participant. At the end of the study, she commented, "apparently my whining and crying paid off because I was included because I was frustrated."

Mrs. Cummings seemed to be very comfortable with the availability of technology on campus. Besides their own classroom technology, teachers were able to checkout mobile computer carts and student clicker response systems. Her campus principal was also pro-technology and willing to obtain technology that teachers wanted to use with students. Mrs. Cummings felt comfortable that she could gain access to any technology she wanted in the district. "We've been very, very fortunate, here in [school district], that if we want something, all we have to do is ask and we get it" (Initial Interview). Mrs. Cummings's school is in a unique place for technology integration, one in which technology uses are encouraged, fostered, and supported. This helped to eliminate several key barriers for teachers when implementing technology, such as access to technology, school culture, support, and professional development goals (Hixon & Buckenmeyer, 2009; Hew & Brush, 2007).

Mrs. Cummings's Technology Aspirations

Once these barriers were overcome Mrs. Cummings was free to dream big with regard to how she wanted to implement technology in her classroom. She had strong beliefs about how the technology could enhance her curriculum, stating, "it would enhance [students'] learning, make it easier, make them more independent, and more,

um, thirsty for knowledge" (Initial Interview). Mrs. Cummings was asked to identify the essential skills students needed to master with regard to technology. In her initial interview, she stated, "I think just feeling comfortable in manipulating it, so that they can explore on their own…independent work." Because she spent a lot of her time working with students during independent work, Mrs. Cummings demonstrated a desire for her students to be resilient when undertaking challenging mathematics problems.

On the other hand, Mrs. Cummings also has the desire to develop students able to direct their own learning. This type of student would thrive in a technology-rich environment where technology is used in student-centered ways. Mrs. Cummings stated that students should be using technology "to research and explore…I see giving them a problem and then letting them decide how to solve it and letting them go on their own to figure it out" (Initial Interview). In addition, Mrs. Cummings envisioned a classroom where she is able to put "students more [in] charge of their learning and less on me" (Initial Interview). Both of these statements hint at her desire for students to be less reliant upon her for assistance, which would allow them to embark on greater depths of learning through the ability to follow their own interests and understandings.

These findings are consistent with the aspirations that Mrs. Cummings expressed during her initial interview. While the researcher never directly asked Mrs. Cummings what she wanted to be able to accomplish with regard to technology, her responses to other questions highlighted the following four desires:

1. Allow students to research and explore their own learning
2. Allow students to use technology to assist in problem solving
3. Allow students to feel comfortable enough with technology to work independently on problems

4. Understand and be able to perform basic troubleshooting for technology and ask for and receive assistance when needed.

Specifically the first three aspirations relate to her desire to create independent thinkers who can exhibit sustainability when problems get difficult and also direct their own learning as they dig deeper into mathematical concepts. As for the last statement, Mrs. Cummings wants access to a support system that can give her assistance when she is implementing technology. It is interesting to note that while Mrs. Cummings wants to create independent thinkers in her students, so that the students learn to work and think through difficulties when related to math, she wants to have someone to rely on when technology gets difficult for her personally. The long-term desire of this study is to do exactly for Mrs. Cummings what she wants her students to do: move to become more independent workers and directors of their learning.

For this study, Mrs. Cummings chose to work with the e-Instruction Mobi™ Board as her first technology of study. The Mobi™ Board is a mobile slate that connects the user to the computer wirelessly using a piece of software called Workspace. The software has tools that allow the user to control the computer as well as to write on screen while being mobile around the room. This is a technology that had already been issued to Mrs. Cummings and one that she admits she uses frequently. When asked what hardware, software, or web resource she was currently using that she felt to be the most useful, Mrs. Cummings responded, "Mobi™…the reason I like that is because of the freedom it gives me to move around the classroom. (Initial Interview)." This freedom of movement assists her in providing content support to her students.

Mrs. Cummings's rationale for selecting the Mobi™ Board included reasons related to the initial set-up stage of Kopcha's model. "I think I would like to explore the Mobi™ Board more, learn how to use it more" (PD Transcript, #1, pg. 9). When she shared how she used the board in class, she stated that there were certain tasks she wanted to do and could not figure out, "the students are kinda (sic) getting stuck, I'm kinda (sic) getting stuck and I'm thinking I wish I knew more about this thing" (PD Transcript, #1, pg. 9).

When asked about specific lessons or ways to implement the Mobi™ Board, she responded, "…it's just that there's gotta (sic) be ways; I mean I keep getting stuck on different things. When I am trying to scroll down the page. When I'm writing the problems or working the problems and I want to leave the work up there and go to the next problem, we can't figure out how to do it" (PD Transcript, #1, pg. 10). In addition to knowing how to use the Mobi™ Board, the teacher mobility when using the technology can assist her in moving around the room to assist her students with problems. Using it solely for this reason may not allow her to move students in the direction of student-centeredness.

Barriers to Mrs. Cummings's Aspirations

Mrs. Cummings demonstrated the desire to implement technology but many of her barriers stopped her from trying. It is interesting to note that her stated barriers in the initial interview frequently related to "if only" barriers, those barriers outside of Mrs. Cummings's control. Connected to Rotter's (1966) locus of control framework, these barriers relate to a teacher's ability to use technology "if only" someone else would fix the hindrances, such as access, school culture, support, testing, professional development

goals, and time to plan. Rotter (1966) found that people with a higher intrinsic locus of control take more risks, while those with more of an extrinsic locus of control are more reserved with risk taking. Because most of her barriers were "if only" barriers, it seemed that Mrs. Cummings had a higher extrinsic locus of control. This allowed her to continue to wait for others to create a pathway of easier technology implementation. An example of one of her "if only" barriers includes the state of technology at her school. Despite being plentiful, the technology was deteriorating with student use. "There's so many problems with the mobile labs so that hinders the ability of the students to use the technology like I want them to" and "I think we have a big problem with students taking care of the supplies and stuff that hinders what we can do" (Initial Interview). Because of these reasons, Mrs. Cummings would oftentimes state hesitation when using technology because she did not feel she could trust her students to use it appropriately.

In addition to the state of technology on campus, other "if only" barriers indicated by Mrs. Cummings during her initial interview, include:

1. Access – this includes not only the condition of school and classroom technology, but also access to technology and Internet for students at home and technology issues related to school wide use (network and bandwidth).

2. Support – Mrs. Cummings desired to have support anytime she was integrating technology. At one point she stated, "sometimes I wish I had [the researcher] in my pocket so that way, you know, 'HELP!' you know, and you'd be there."

3. Professional Development Goals – Mrs. Cummings felt that there was a training deficit causing her to not know how to use the technology effectively.

Mrs. Cummings also dealt with "what if" barriers. This type of barrier deals with issues that lie within the control of the teacher and are typically phrased as "what if" something happens, what will I do? As stated earlier, these "what if" barriers fit within the intrinsic locus of control as defined by Rotter (1966), because these barriers deal with

her own intrinsic motivation. Examples include attitude (Hixon & Buckenmeyer, 2009; Hew & Brush, 2007), interest (Neiderhauser & Perkman, 2008), time (to learn, play, apply the technology to a lesson) (Hixon & Buckenmeyer, 2009; Hew & Brush, 2007), knowledge and skills (knowledge of how to use one technology) (Hixon & Buckenmeyer, 2009; Hew & Brush, 2007), and ability (capability to transfer knowledge of one technology to a similar technology) (Velazquez, 2007). Mrs. Cummings did not struggle with barriers of interest or attitude; however, she indicated a significant deficit in knowledge and skills. She expressed a concern that she did not know enough to be able to implement it effectively. Mrs. Cummings discussed not even knowing what technology was available to her. "How do you know what would be useful if you don't know what you are missing" (Initial Interview)? In addition, she was not sure how to use what technology she had effectively, and particularly what to do if the technology did not work properly.

Mrs. Cummings spoke frequently about her student accountability issues. She stated, "My biggest problem is that I am scared that they are going to destroy stuff," and "one of the problems that we have with using the technology is the students taking care of it…I think we have a big problem with students taking care of the supplies and stuff and that hinders what we can do" (Initial Interview). What is interesting about this particular barrier is that Mrs. Cummings viewed it as a "if only" barrier, while the matter may very well be a "what if" barrier instead. Mrs. Cummings believed that if the students would be more responsible, or if there were ways that students could be held accountable, this barrier might be alleviated. This may be true, but the barrier may actually be a "what if" barrier in which Mrs. Cummings needed to consider what she should do in regard to

classroom management to alleviate the issues. As for student accountability as an identified barrier, the researcher could not determine whether it fit into any of the categories of barriers as defined by the research outlined in Chapter Two. Therefore future research may reveal this notion as a new category. It is apparent from the data gathered in this study that student accountability is a major barrier for Mrs. Cummings's use of technology in her classroom. Perhaps, as indicated, the barrier is actually classroom management and not student accountability.

Desire for knowledge and skills are what prompted Mrs. Cummings to select the Mobi™ Board for study. She had already used this tool in her classroom, yet she still had the desire to learn more about it in order to feel more comfortable using it effectively. Of great concern during the training sessions was her ability to switch between the live view of a website and a screen shot of the same website. The screenshot allowed her to use the onboard writing and drawing tools to write, circle, draw, work out problems directly on the webpage itself. The screenshot would then be saved as a slide in a photo drawer for later retrieval. This allowed the teacher to create a slide once and show it multiple times. Mrs. Cummings was able to use this functionality well, but would complain constantly about losing the screen she was working on when she switched to the live webpage again. The majority of training sessions started or focused on this particular skill. The difference between a red "x" (closes the program) and the mouse button (allows user to select another function within the program) caused much confusion and struggle for Mrs. Cummings. During the training sessions she would understand and use the mouse button instead of the red "x" but then would fail to remember how to do that the next training. By the end of the study, Mrs. Cummings was finally able to remember. It was the basic

knowledge and skills that held Mrs. Cummings back from being able to use the Mobi™ Board effectively. Because she was uncomfortable and unable to remember how to use that one feature, she was too timid to move beyond what she was comfortable with, which was using the board as a mobile mouse for her computer. She kept trying and never gave up with the Mobi™ Board. By the end of the study, she was able to use other features of the Mobi™ Board effectively.

Mrs. Cummings still faced barriers to technology use by the end of the study, which is to be expected. As predicted, her barriers changed as she experienced the individualized trainings throughout this study. Initially, she was asked what she would need in order to improve her skills with technology. Her response was simple, "One on one help. Troubleshooting; I know enough to get myself in trouble and that's usually what happens" (Initial Interview). While her response to this question in the final interview still included troubleshooting, she clearly moved from the desire for specific one-on-one assistance to the need for a community of learners on which to rely when using technology. In the final interview, her response was that she needed, "more patience. Um, I think just, just training, just troubleshooting training. So and just help from other people, if that makes sense. So that we can all get through this together" (1st Individualized PD Plan Meeting).

"What if" barriers, specifically troubleshooting, still plagued her, but many of the questions in which troubleshooting was an issue for her during the initial interview, she moved away from in the final interview. When asked, "what specific barriers (not hardware, software, or web resources) do you face when implementing technology into your classroom," Mrs. Cummings responded in the initial interview with, "those little

technical things that I do not know how to handle, that maybe somebody else does…when it has a problem then I'm stumped." When asked the same question in her final interview, her response focused more on issues that had arisen from her actual use of technology. "I think the biggest barrier is just the students that I have wanting to be spoon-fed everything…. trying to get the students to actually try to do it on their own and to feel like they can be a little bit independent." This is a significant shift since it indicated that Mrs. Cummings experienced barriers related to actual use of technology rather than troubleshooting which may or may not be a barrier that surfaced from the implementation of technology. Further proof of this point comes from responses she provided based on the question, "What practical factors hinder your ability to involve students in hands-on technology activities?" In the initial interview, Mrs. Cummings stated, "I think my biggest problem is that I am scared that they are going to destroy stuff." In the final interview, Mrs. Cummings replied, "I think it is a matter of the students wanting one-on-one instruction instead of being able to take a chance and try." While barriers may never be completely overcome, it is encouraging that Mrs. Cummings was making progress to overcome those that hindered her in the beginning of the study.

How Technology Was Used in Mrs. Cummings's Classroom

In addition to the Mobi™ Board, projector, document camera, and laptop computer that had already been introduced, Mrs. Cummings utilized other technologies in her classroom. She had an eInstruction® Interwrite™ Board in her classroom, but as mentioned before, she only used it to project an image from the projector because her mounted whiteboards are too stained for the image to show up well. Her classroom was equipped with four desktop computers, three of which were designated for student use.

The fourth was used as a teacher computer. The student computers were located at the back of the room away from the main instructional area of the classroom. Mrs. Cummings had also been given a class set of Texas Instruments® TI-Nspire™ graphing calculators that were purchased through a district-wide Algebra Readiness Grant. The grant not only provided the calculators but it also offered monthly training and support from a Texas Instruments® representative as well as the District Algebra Readiness Grant facilitator.

Additionally, Mrs. Cummings had been issued an Apple® iPad® by the school to use in class. Mrs. Cummings never listed this as a technology she used in her classroom. As a matter-of-fact, after having an iPad® for several months, she stated, "I'm still trying to figure out that iPad® that we have" (Initial Interview). Despite having it for a while, Mrs. Cummings appeared to view it separately from a tool that can be used in her classroom since she never listed it when asked what technology she has access to in her classroom. She only mentioned it when asked what technology she has access to outside of school. Perhaps the barrier for this technology is far too great for her to even imagine it as a tool in her classroom.

Mrs. Cummings did take advantage of some of the equipment available for teachers to checkout for individual classroom use. This included sets of eInstruction® CPS™ Student Response Systems and mobile laptop carts. There was an additional computer lab that the teachers could reserve and take their students to for instruction. When using the computer lab, Mrs. Cummings utilized a web-based tutoring program from Hotmath, Inc.®, called Catchup Math™ (http://catchupmath.com). This program allowed students to work independently on areas of weakness while Mrs. Cummings

monitored their progress and assisted as necessary. As with other activities, the students were still very reliant upon her assistance even with the computer work.

As the study progressed, it was an encouragement that Mrs. Cummings was able to articulate more ideas for uses of technology in her classroom. Despite making small progress with the Mobi™ Board during the trainings, what she did accomplish by the end seemed to help her identify more ways to use the technology with her students. Initially, Mrs. Cummings discussed her current technology use in very general terms, such as, "I have a laptop, I have an overhead projector. I have a Mobi™ Board and I have, not a SMARTboard™, but it's the [eInstruction®] Interwrite™ Board. I have clickers. I have the TI N-Spire calculators." This statement is just a listing of her technology, especially when compared to her answer in the final interview, in which she gave some examples of how she uses those technologies.

> I am using the Mobi™ Board for anything that I can get off the computer. And I've also learned how to use it for just paper, so I've added that recently. Um, I use the TI-Nspire™ calculators for projects. Um, is that it? I use my laptop for, you know, to assist in my lesson plans. Um, I'm thinking. I use United Streaming. I use, you know, web video, web, I use, what I call live streaming videos and extra stuff for my students.

While it is plausible that her ideas could have come from additional places other than the individualized training sessions, the fact remains that she was either unwilling or unable to search for additional uses prior to participation in this study.

It was disheartening that one year after the completion of the study, Mrs. Cummings's list of technologies used in her classroom did not include many of the technologies she listed during the study. "I use [TI-Nspire™ calculators] daily for warm-ups, instruction, quizzes, entering homework, etc. I use my SmartBoard and [Mobi™ Board] for instruction and student engagement."

Progress Toward Student-Centered Understanding

According to Mrs. Cummings, she used technology as a way "to enhance knowledge. To introduce, to reinforce, to assess" (Initial Interview). She readily admitted that her students knew more about the technology than she did, and that she allowed them to assist her when she was stumped. These statements point toward a student-centered technology understanding since she had the desire for her students to be more of a participant in the use of the technology and learning. Other statements corroborate what she professed, but there is little to no evidence that her ideology was put into practice in her classroom. As a matter-of-fact, in line with her struggle with student accountability, as discussed earlier, she had difficulty controlling the direction of the lesson and providing activities that would engage the students in tasks requiring critical thinking skills. The researcher noted at one point that if Mrs. Cummings could institute differentiated lessons, it might make a difference in the ability of her students to work more independently and assist her in controlling the classroom. During the study, her lessons all tended to be whole class lessons except when using the Catch-Up Math program in the computer lab.

One movement toward student-centered thinking indicated in the study came during her initial interview, in which Mrs. Cummings stated,

> Recently I did an assessment over a topic we have just done and we did it on the TI-Nspires™. I handed them a hard copy of the questions, but then they also put them into the calculators so we could get immediate feedback so they could see how they did.

Immediate feedback assisted students in seeing their errors and learning from their mistakes. By providing them the instant feedback, Mrs. Cummings was using technology to assist her in moving toward student-centeredness.

As mentioned previously, most of Mrs. Cummings's student-centered thinking was only spoken and was not witnessed in practice. As a matter-of-fact, almost all of her statements that indicated her shift in thinking were evidenced through her responses to questions about her ideal classroom. These responses were rich in student-centered understanding. It was obvious that Mrs. Cummings wanted to have a classroom that allowed technology student-centeredness, but she was unsure how to achieve it given the hindrance of her current barriers and classroom management.

The ability to use technology to support learner-centered strategies was evidenced by several statements made by Mrs. Cummings during her initial interview, but was not corroborated in any other data collection method. As a matter-of-fact, she responded to one of the researcher's questions with an answer that hinted at being a learner-centered classroom environment, but no other data was ever witnessed to support her claims. "[I use technology] to enhance knowledge. To introduce, to reinforce, to assess. I've used them in every phase of the lesson plans." Later, in the same interview, when she was asked to envision her ideal classroom and describe how students would be using technology in that room, her words echoed a learner-centered classroom: "To research and explore. That's what I see. I see giving them a problem and then letting them decide how to solve it and letting them go on their own to figure it out." While the learner-centered philosophy is expressed by Mrs. Cummings, what was witnessed in other data collection methods better align with her response to the question, "What hinders your ability to involve students in hands-on technology?" "I think my biggest problem is that I am scared that [students] are going to destroy stuff." This sentiment proved her inner

conflict with what she believed and what she is capable of doing in her classroom with her students.

Despite this inner conflict, her beliefs about student-centered instruction continued to get stronger throughout the study. When asked to envision her ideal classroom, Mrs. Cummings was fairly consistent with her answer from initial to final interview. In both she responded with answers that indicated a desire to have students work through problems by having them decide how best to solve them with whatever means necessary. In the final interview she specifically added technology as a means that she would approve of, when she stated, "My ideal classroom would be they come in and they grab whatever technology they can get ahold of and they go to town." Adding technology in the final interview would indicate that Mrs. Cummings has come to view technology as a useful tool for student learning. Even one year after the study, her statements regarding student-centered instruction remained positive. According to her, she would envision "putting students more [in] charge of their learning and less on me."

These statements indicated that while she was not practicing student-centered instruction, she envisioned it for her students. As with the use of technology, Mrs. Cummings attitude and interest is not a barrier for her; however, she is still held back by the lack of knowledge and skills to implement them. With proper professional development opportunities and follow-up support, Mrs. Cummings may be able to overcome this barrier and put her beliefs into practice.

Professional Development Needs

In order to overcome her barriers and reach her aspirations, Mrs. Cummings needed a professional development plan that would meet her specific needs. Mrs.

Cummings had definitive ideas about topics with which she specifically needed assistance. She desired, "One on one help. Troubleshooting; I know enough to get myself in trouble and that's usually what happens" (Initial Interview). When asked what hardware, software, or web resource would be the most useful if the teacher had access to it, Mrs. Cummings stated, "I'm not really sure how to answer that. I mean, how do you know what would be useful if you don't know what you are missing?" While in this statement Mrs. Cummings did not indicate what professional development she needed, the statement does indicate that she does recognize that what she does not know must come from someone other than herself. Even with professional development opportunities, Mrs. Cummings continued to indicate that she specifically needs one-on-one assistance to be successful. Responding to a question about her satisfaction with the professional development opportunities offered through the school, she stated,

> I am happy with it, I'm not happy in that I feel that I wish there was some more training for it. Some more one-on-one (sic). I wish I was able to have somebody who was not running around like a chicken with their head cut off all the time, you know, that I could ask more help from (Initial Interview).

For Mrs. Cummings, professional development opportunities were not enough to ensure her success with technology in her classroom.

During the course of this study, Mrs. Cummings experienced both traditional professional development (Technology Tuesdays and other district-based trainings) and a differentiated professional development (this study). In the final interview, the researcher asked Mrs. Cummings to discuss what elements of both a traditional and differentiated professional development that she found most useful. With regard to the differentiated training she had just received, Mrs. Cummings stated

> Getting exactly what I needed instead of a broadcast. Instead of generalized, it was what I wanted, it was the questions I had. Instead of sitting in a room with 40 people, and everybody else having their questions answered, if I had a specific question, I had your attention and I could get answers to it right then.

She also found beneficial elements of a traditional professional development,

> I would have to say the collaboration with the other teachers. Because this right here is just you and I (sic). When you are in a big setting, then you have 40 or whatever different minds all working, and you can get so many great ideas from other people and they can help you solve your problems…where a traditional would give you a lot more availability of ideas.

The fact that she felt she could get answers to her questions in either setting was interesting to note, as Mrs. Cummings seemed to feel confident that she could gain from either setting. However, when asked how both traditional and differentiated professional development models might be improved, her responses gave insight to which model she preferred. Speaking of traditional models, Mrs. Cummings stated, "if they gave more time, so much of it is just lecture, but if they gave more time where there was collaboration with people in the room" (Final Interview). This indicated that she could see the potential for benefit from traditional professional development opportunities if the trainer would allow more collaboration among the participants. When asked how a differentiated model might be more effective, Mrs. Cummings indicated that more observations might help the trainer to be able to point out areas of weakness unaware to Mrs. Cummings. "If you came in and saw that I was doing something, I might not realize that I needed help with that" (Final Interview).

In the final interview, Mrs. Cummings was asked how she might design her own professional development if given the opportunity. Her response reflected her answers related to making each model better, "I think I'd want it to be broad based to where it's in a group setting but where you could have collaboration with the other teachers." It is

interesting that she does not mention characteristics of a differentiated model despite stating that she liked having her questions answered immediately and after categorizing her comfort with the Mobi™ Board before the differentiated model as "frustration" and after as "a lot more confident." Additionally, when asked to compare and contrast the two models, her answer indicated her preference by her use of positive language to describe differentiated professional development and negative language to describe the traditional model.

> Well, the differentiated, I mean, you were looking at exactly what I needed whereas the traditional, we're just throwing everybody in a group and we're just doing a broadcast. Where this was more specific as to what I needed. So I think it was a lot more effective.

Perhaps Mrs. Cummings preferred the differentiated model but seemed to miss the collaborative piece that the traditional model afforded her. Mrs. Cummings's repeatedly discussed needing technology to meet her individual needs as well as desiring one-on-one assistance. These requests point to the fact that without follow-up support, a traditional professional development model cannot currently meet her technology learning needs.

Follow-up Support Needs

Support was a crucial component for Mrs. Cummings to feel like she was able to make progress with technology and student-centered thinking. Throughout all of her interviews, her comments were sprinkled with the desire for someone to be available to work with her more often. At one point in her initial interview, she stated, "Sometimes I wish I just had [the researcher] in my pocket so that way, you know, 'HELP!' you know, and you'd be there." She realized that she has to rely on others for knowledge related to her computer and technology use. "Those little technical things that I do not know how

to handle, that maybe someone else does, but I just don't know how. I can usually run it, but when it has a problem, then I'm stumped."

According to Mrs. Cummings, having several people on campus that she could call to assist when there was problems would help to alleviate this barrier for her. She stated that it would be nice if "there were several people here that knew what they were doing so that way we can take care of the problems faster. That would be nice" (Initial Interview).

This need for support was evident during the training sessions with Mrs. Cummings. As mentioned previously, Mrs. Cummings was having a difficult time remembering how to correctly switch between the live view of a webpage and the screenshot of a webpage that she was able to notate over using the Mobi™ Board tools. Switching between the two required the user to click the mouse button on the toolbar, which would then allow a new window to be selected. Mrs. Cummings continually used the red "x" which closes out the program without saving her work. This was frustrating her, as she had to recreate her pages in every class period. During almost every training session, this issue came up and was readdressed; however, Mrs. Cummings would forget by the next training time. The researcher planned for various other topics during the training sessions, but eventually realized that perhaps Mrs. Cummings was too overwhelmed by the many tools and that maybe focusing on one or two until mastery would be more beneficial. It was only after this was put into practice that Mrs. Cummings began to make more rapid progress with the Mobi™ Board tools.

One additional way that Mrs. Cummings felt she could benefit from support was through more specific feedback from the researcher. "If you came in and saw what I was

doing something, I might not realize that I needed help with that" (Final Interview). This openness to suggestion speaks to her attitude and interest in improving her technology use.

It was determined that her need for follow-up support was the rationale for her selection of the TI-Nspire™ calculators as the second technology choice she would have liked to study if she had made it through the entire model in the study timeframe. It was interesting to the researcher that Mrs. Cummings would select a second technology with which she already had access and was utilizing with her students. Originally it occurred to the researcher that perhaps Mrs. Cummings was really struggling with her concern of being able to troubleshoot any issues. Finally, the researcher concluded that the TI-Nspire™ trainings were short and insufficient to answer her questions. Since it was a district level grant, implementation of the calculators into the mathematics classrooms was essential. This created a scenario where Mrs. Cummings needed and desired to understand how to use them to their most effectiveness, thereby creating a need for her to have follow-up support.

Mrs. Cummings's Conclusion

Mrs. Cummings was open and willing to learning more about technology uses for her classroom. During the course of the study she was never afraid to admit when she did not understand or could not remember how to do a particular function with the technology. When she had questions, she was not timid to ask for assistance from the researcher.

Mrs. Cummings's technology aspirations. Mrs. Cummings wanted to be a part of this study in order to put herself in a position to learn more about technology. Very early on she believed that technology could make an impact on her teaching and her students' learning. Some of her aspirations seemed minor, such as troubleshooting and using the Mobi™ Board tools, but they were big ideas to Mrs. Cummings. Her other aspiration seemed to be on the opposite spectrum from these knowledge and skills issues: creating a more student-centered classroom environment for students. While they do seem to be extremes, it is commendable that Mrs. Cummings could see past her own barriers (knowing what to do if the technology does not work properly) and see the potential that technology could have in her classroom. For Mrs. Cummings, or any teacher, having student-centered technology aspirations could assist the teacher in seeking out ways to overcome the knowledge and skills of technology, or whatever the barrier may be, in order to achieve that student-centered classroom.

Barriers to Mrs. Cummings's aspirations. As stated, Mrs. Cummings had barriers that related to the usage of her Mobi™ Board alongside dreams of a student-centered classroom. Even though she started and concluded the study with many barriers to technology use, her barriers changed. She exhibited barriers that were connected to both "what if" barriers and "if only" barriers. Mrs. Cummings' barriers at the end of the study still included both types of barriers. Yet, she began to look past just receiving assistance from the researcher as her trainer, and began to notice that others on campus had specialized knowledge that could also assist her when needed. Her biggest barrier seemed to be her classroom management abilities. Interestingly, she viewed these as a "if only" barrier because she believed that the students are irresponsible and unable to work

independently. While this may be true, most of this issue dealt with a "what if" barrier, yet she did not recognize it as such. For Mrs. Cummings, classroom management issues were much more than simply controlling the students in the classroom. Her classroom struggles stem also from her inability to transition between activities, build differentiated lessons that allow for students to work at their own pace and not be required to wait for Mrs. Cummings to guide every step, and provide instant feedback to students on their progress. Once Mrs. Cummings masters classroom management skills, coupled with her strong beliefs, it is expected that she should be able to overcome more of her knowledge and skills based "what if" barriers. At that point she will be able to begin to see her student-centered classroom become more attainable.

How technology was used in Mrs. Cummings's classroom. While she continued to use the same technology throughout the study, Mrs. Cummings began to have more ideas of ways to actually use the technology toward the end of the study. Through discussions and trainings, and perhaps with a little bit of success with the Mobi™ Board, Mrs. Cummings began to explore more ways to use technology. At the beginning of the study, she could only articulate a list of technologies available to her, while at the end she included ways that she used the technology. This may lend credence to the idea that the more a teacher uses technology, the more apt they are to find new ways to integrate it into their classroom. Though none of her technology was being utilized in student-centered ways, progress here was simply the fact that she could identify ways to use the technology in the classroom and those ways were increasingly more student-centered ideas.

Progress toward student-centered understanding. Growth was seen in her more defined student-centered philosophies, although none were put into practice during the course of this study. As previously mentioned, Mrs. Cummings developed student-centered ideologies, but was unable to employ them into her classroom, presumably due to the knowledge and skills barriers she faced with the technology in her classroom. It is significant that she continued to develop the ideas that technology can assist her students in become more engaged learners. It seemed to be an aspiration that she holds in high esteem, but struggles to move toward implementing. In time, and with additional professional development and follow-up support, it is expected that Mrs. Cummings will be able to overcome enough knowledge and skills barriers to begin to implement her student-centered classroom.

Professional development needs. Mrs. Cummings needs to have professional development opportunities that will allow her to collaborate with others in order to gain ideas, but then offer focused individual follow-up trainings to help her meet her more specific needs. With a stronger knowledge and skills for specific technologies, she could then begin to transfer that knowledge to other technologies. Without the follow-up support by a mentor, Mrs. Cummings could easily slide back into her old habits and give up out of frustration. Had frequent trainings not be instituted during this study, it is certain that Mrs. Cummings would have not been able to remember how to switch between the live web view and the screenshot view when using her Mobi™ Board. She was frustrated with that particular function during the training, but the sustained support assisted her in finally, after several weeks, mastering that skill.

Follow-up support needs. As just mentioned, it is crucial for Mrs. Cummings to have a mentor that can provide sustained support for her technology integration. A cohort of teachers on campus may work for her, but only if they hold her accountable. If left to her own devices and with only traditional professional development opportunities (those without a follow-up support included) as her sole means of learning new technologies, Mrs. Cummings will not continue to progress toward her student-centered ideology.

Case Study: Donna Clayton

Mrs. Clayton Introduced

Donna Clayton (pseudonym) is a Caucasian female in her twenties. She had three years of teaching experience, all within the content of mathematics, and all at her current position in eighth grade mathematics. She also completed her student teaching at her current campus. Mrs. Clayton generally presented content to students through the avenues of lectures and small group activities. She possessed a good rapport with her students and they appeared to work diligently in her classroom. Other teachers revered Mrs. Clayton as a high-tech producer because she integrated technology frequently into her lessons. Teachers on campus often talked about Mrs. Clayton as who they go to if they have technology questions.

Mrs. Clayton's classroom was set-up in two major student sections with a walking aisle in between the two. Both sections faced each other, being on opposite sides of the room, but neither faced the front of the room (the wall with the whiteboard). Within each section, the student desks were in straight rows with four desks in each row. Mrs.

Clayton spent a lot of her time walking the main aisle between the two sections as she instructed the classroom.

Despite being viewed as a high-technology producer by her peers, Mrs. Clayton's use of technology was focused on teacher assistive technology. She utilized an eInstruction® Interwrite™ Board and Mobi™ Board in her classroom on a daily basis. Texas Instruments® TI-Nspire™ calculators and CPS™ Student Response Systems were visible frequently in the hands of her students. None of these tools were being used to allow students to direct their own learning; rather they were used as a way for Mrs. Clayton to deliver content. While Mrs. Clayton used technology frequently, it was still considered teacher-assisted technology because she used it mostly to instruct the students.

Despite being a teacher that was known on campus for her technology use, Mrs. Clayton scored in the Early Technology category of the Technology Self-Assessment Tool (TSAT), missing the Developing category by just two statements. After careful consideration of the two statements, the researcher disregarded them because the content had no bearing on the study. One statement related to the use of assistive technologies and the Universal Design for Learning. This question was disregarded because Mrs. Clayton did not teach student with any types of assistive devices and therefore would have little to no knowledge of how to use those devices. The second statement indicated a teacher could discuss pertinent research related to technology integration. Whether she could discuss the research would not indicate her ability to integrate technology. Because of the removal of these two statements, Mrs. Clayton was moved up to the Developing category.

Mrs. Clayton was extremely involved in the technology focus of the campus. She attended every Technology Tuesday, even though participation in this study exempted her from attending. Tools and resources presented in Technology Tuesday trainings were frequently observed in her classroom following the training. Mrs. Clayton was an avid contributor to the campus Blog, where she would detail how she was using technology in her classroom.

Mrs. Clayton felt comfortable with the technology availability on her campus. In addition to the technology she had in her own classroom, she had access to mobile lab carts, Student Mobi™ Boards, and CPS™ Student Response Systems through a checkout process initiated by the Instructional Specialists. When asked about access to technology on her campus, Mrs. Clayton stated that it was "easy because most of the stuff is on campus and all we have to do is check it out" (Initial Interview). Mrs. Clayton's school was in a unique position for technology integration, one in which technology uses were encouraged, fostered, and supported. This helped to eliminate several key barriers for teachers when implementing technology, such as access to technology (Hixon & Buckenmeyer, 2009; Hew & Brush, 2007), school culture (Hixon & Buckenmeyer, 2009; Hew & Brush, 2007), support (Hixon & Buckenmeyer, 2009; Hew & Brush, 2007), and professional development goals (Hixon & Buckenmeyer, 2009).

Mrs. Clayton's Technology Aspirations

Once these barriers were overcome, Mrs. Clayton was free to dream big about her technology integration. First of all, Mrs. Clayton wanted to do a better job at utilizing the technology she already had available to her. When asked about her technology desires, she stated that she wanted

> More lesson example ideas of different ways I can incorporate it, just instead of using like Workspace to show examples and Workspace to work out things and do competitions, just different things I could do with the Interwrite board. Um, and with the calculators, I mean there is plenty we can do with the calculators, but I'd like to use them more time efficiently because sometimes the time gets away from us with those (Initial Interview).

In addition to wanting to know additional ways of integrating, Mrs. Clayton also wanted her students to be more proficient in using technology. When discussing essential skills that students needed, in both the initial and final interviews, her answers indicated that students simply needed the basics. In the initial interview, basics included "knowing how to get to something in a browser, knowing where the URL address goes." This sentiment did not change much by the final interview. During that time, Mrs. Clayton indicated that her students still needed to know "the basic functions of how to use the keyboard, how do you use just the menu options, and everything on a computer." In the final interview, Mrs. Clayton not only added additional skills that she felt her students needed, but they were skills not related strictly to the computer. "And when it comes to the TI-Nspires™, I want them to be able to know how, know how to login by themselves, know how to submit polls and to submit documents." It was significant that even though she just expected students to know the basics of technology use, by the end of the study she broadened her ideas of what technology encompassed. Essential computer skills were not enough for her students any longer; they must have basic skills with other technology as well.

Her answers for what essential skills she felt teachers needed for technology showed growth in her usage of technology with her students. In the initial interview, she stated that teachers "have to know more than the kids because the kids are always going to be one step ahead of you…teachers have to pretty much know everything." The idea

that teachers must understand everything about a technology before they can infuse it into their lessons is an unrealistic ideal that Mrs. Clayton held at the beginning of the study. She was right in considering that students could be one step ahead of teachers with technology, simply because technology use is second nature to many of them.

What intrigued the researcher was Mrs. Clayton's statement about students always staying one step ahead of teachers. In the initial interview, Mrs. Clayton used this as an argument for teachers to have to know everything about a technology before being able to implement it successfully. In her final interview, she made a similar statement, but this time it was used as an argument for knowing only the basics of technology.

> For a teacher to be successful, we have to know how to print, how to save, how to, you know, good keyboarding skills, how to email, how to create Word, how to create, you know, Excel, any Microsoft Office, how to navigate the internet. How to, I mean, just all the basic functions because if we don't know it we are one step behind. I mean, you can go on and on and on with how many things we have to know. I mean, pretty much, just good computer usage.

What begun with staying ahead of students by knowing a lot, ended up as knowing only the basics so that teachers do not fall behind educational practices. This shift from teachers having to know everything initially to knowing only the basics was indicative of Mrs. Clayton's usage of technology in her own classroom. Perhaps by integrating technology, she was able to see that she could learn with the students effectively and that her time trying to learn everything about a technology prior to its use was wasted.

Mrs. Clayton's biggest aspiration seemed to revolve around providing access to her mathematical content via the web, specifically through a web-based tool called Edmodo™ (https://www.edmodo.com). She specifically stated that she wanted to make her classroom into a "virtual classroom and a one to one ratio" (Initial Interview) by using technologies such as Edmodo™ to facilitate classroom activities, homework

activities, and discussions. The format of Edmodo™ is similar to Facebook™ but within the confines of a classroom network. Edmodo™ would allow Mrs. Clayton to create classrooms, open only to her students. Comments and posts would be private to only the group of students enrolled along with Mrs. Clayton.

Additionally, Edmodo™ would allow Mrs. Clayton to send attachments, create short quizzes and post academically related questions for her student to discuss. Students could also post attachments so that they could turn in their assignment to the teacher without having to flood the teacher's email account. Quizzes created through Edmodo are graded automatically sent to the teacher for recording. This platform would allow Mrs. Clayton to be able to conduct much of her class online without having to copy assignments and distribute them to students physically.

Mrs. Clayton's desire to use Edmodo™ in her classroom matches with the aspirations that she discussed during her initial interview. While the researcher never directly asked Mrs. Clayton what she wanted to be able to accomplish with regard to technology, her responses to other questions highlighted the following three desires:

1. One-to-one ratio of computers to students with 24/7 access to all classroom curricular resources
2. Pilot Edmodo with her lab classes (those students who come to her for an additional period of mathematics because of their previous achievement on standardized tests or failure of another mathematics course)
3. Create a virtual mathematics classroom for students

The second and third aspirations specifically connected to her desire to use Edmodo™ with her students.

As for the first aspiration listed above, it indirectly connected, as many of Mrs. Clayton's students did not have access to technology or the Internet at their homes.

Because of this need, Mrs. Clayton was searching for ways to help alleviate the need for technology at home while still utilizing the Edmodo™ platform in her classroom. Mrs. Clayton knew that many of her students had cell phones but not necessarily Internet access at home. Because the school had a wireless Internet connection, she desired to allow students to use their phones to connect to the Internet and access their Edmodo™ account while at school. In her understanding, this could assist in allowing more students to have access to the material, even if they had to access it during lunch, or other free time while at school.

While the study of Edmodo™ for this study was simply a trial with a small group of students, it was Mrs. Clayton's desire to then extend the use of Edmodo™ to all of her classes following the administration of the state-mandated tests. She specifically hoped to differentiate her content for her students by offering

> self-paced instruction to where assignments would be assigned on the Monday and then it would be due by a certain day and so they could sit there and work an assignment until they reached whatever grade they would like to achieve. And if one kid is struggling with integers, well then they can receive one-on-one help with the teacher in the room to help them through that while another kid who worked really well with integers can go ahead and move on. (1st Individualized PD Plan Meeting).

Her interest in a tool such as Edmodo™ continued to drive her aspirations, as evidenced by her selection of a second technology of study should she have finished with the entire Kopcha (2010) model. For her second technology, she selected Schoology® (https://www.schoology.com), which is almost identical to Edmodo™. The researcher was surprised that she selected a tool that did the exact same things as the one she just spent months working to learn. One redeeming quality to this selection was that she intended to compare and contrast Schoology with Edmodo to see if one was more

appropriate for her own students. Because she had already worked with Edmodo™ and identified characteristics that she liked and disliked, she was able to compare and contrast it with Schoology for a tool that would assist her in conducting her classroom in a manner that she desired.

Barriers to Mrs. Clayton's Aspirations

As previously discussed, Mrs. Clayton was considered to be a high technology producer on her campus. Even though most of her stated barriers in the initial interview could be connected to "if only" barriers, she typically faced the barrier after trying to use the technology, rather than allowing the barrier to keep her from trying the technology at all. "If only" barriers are those barriers outside of Mrs. Clayton's control. Connected to Rotter's (1966) locus of control framework, these barriers relate to a teacher's ability to use technology "if only" someone else would fix the hindrances, such as access, school culture, provided support, mandated testing, professional development goals, and provided time to plan. Even though most of her barriers were "if only" barriers, which seem to connect to the extrinsic locus of control, Mrs. Clayton's ability to continue to strive to make the technology work by bypassing those barriers indicate that she has more of an intrinsic locus of control as defined by Rotter (1966). Most teachers allowed the "if only" barriers to be the reason they cannot try technology; however, Mrs. Clayton seemed to be able to try a technology until she faced a barrier that she cannot figure out a way around.

Mrs. Clayton was asked specifically about the barriers she faced when implementing technology. Among her list of five barriers, three could be classified as "if only" barriers:

1. Time – Mrs. Clayton had expressed concern that she would not have enough time to cover all the student expectations.

2. Access – Mrs. Clayton discussed several issues related to the access to technology that she and her students faced: district proxies that prohibited access to certain websites; the need for various browsers to make sure all plug-ins would work properly; differing versions of software across the building; the lack of working equipment on campus; and the physical set-up of the classroom that included certain locations for Internet drops and only two electrical plugs per room.

3. School Culture – Based on her concerns for the safety of the technology and lack of student responsibility to take care of it, Mrs. Clayton discussed the need for the school to adopt a policy for technology use. She believed that this policy, including disciplinary action for destroying technology, would help in maintaining better working equipment school-wide.

Mrs. Clayton had two additional barriers that the researcher could not immediately classify as an "if only" or "what if" barrier. The following two barriers could easily fit into either category depending on how Mrs. Clayton viewed the barrier being overcome. If she felt that she needed to search for answers to these barriers in order to overcome them, then they are "what if" barriers; however, if she expected answers to come from professional development trainings or from follow-up support, the barriers are "if only" barriers. It is possible that they could be a combination, or could be classified based on how they were resolved, in which case they are "if only" barriers because they were specific goals of the differentiated professional development trainings set up during this study.

1. Knowledge & Skills – Specifically, Mrs. Clayton desired more implementation ideas for the technology she already had access to in her classroom. She desired to make class more interesting to her students in order to keep their attention. She also felt that she needed to know a lot about how to use any technology she desired to integrate into her classroom stating, "you have to know more than the kids because the kids are always going to be one step ahead of you…teachers have to pretty much know everything" (Initial Interview).

2. Ability – Mrs. Clayton struggled with making technology more student-centered.

By the end of the study, Mrs. Clayton's barriers changed and became even more focused on "if only" barriers. As previously discussed, Mrs. Clayton's intrinsic motivation to utilize the technology enabled her to work with the technology to the best of her ability and then stop when a barrier could not be overcome or sidestepped. In the initial interview, Mrs. Clayton expressed that she needed "more lesson example ideas of different ways I can incorporate [technology]." By the final interview, Mrs. Clayton's technological barriers shifted to needing, "dummy guides, if something went wrong. A quick way to fix them." Again, it is noted that Mrs. Clayton does not use the "if only" barriers as a reason to not use the technology; she simply desires a resource that could assist in moving through the barrier quickly when faced. Another explanation may be that initially her need for ideas was fulfilled and then by merely implementing the technology she found that help guides would assist her in making the most of her class time. This would show that, for Mrs. Clayton, her implementation led to new barriers.

Another barrier that changed for Mrs. Clayton was time. Initially, when asked specifically about her barriers, she responded that one of them was time, specifically class time to implement technology and planning and preparation time to use it with students. She also mentioned that the lack of some working equipment played a factor in this time issue, indicating that, "it's just more pain than it's worth sometimes when the technology doesn't work." By the final interview, when asked the same questions, Mrs. Clayton never mentioned time as being a barrier. As a matter-of-fact, she only mentioned the non-working equipment as a barrier. Even in her explanation, it seemed that she is

more frustrated with the equipment and did not consider it as a time barrier to her classroom:

> sometimes, I mean, things won't load off the network, the network will be down, or it kicks me on and off the wireless connection depending on what laptop we're on. Um, or I mean, most of it is just technological glitches or the equipment itself is faulty and so you have to kinda (sic) make do.

Her statement, "you have to kinda (sic) make do" indicated that the frustration of the non-working equipment is not enough to keep her from continuing to use the technology. This is a significant shift in technological ideology from the "its just more pain than it's worth" statement she made in the beginning of the study.

The final barrier that changed from initial to final interviews for Mrs. Clayton was related to the question asked by the researcher, "What practical factors hinder your ability to involve students in hands-on technology activities?" During the initial interview, Mrs. Clayton discussed the lack of student responsibility in caring for the technology available to the students. At one point, she even stated that having to go over the rules every time she wanted to use technology was "more of a time drain." She indicated that the school needed to initiate a school-wide policy meant to address the misuse of technology and repercussions for breaking those rules. While there was no such school-wide policy initiated during the study, Mrs. Clayton did continue to use technology with her students. By the end of the study, she stated that the practical factor hindering her ability to use technology with her students was the availability of working equipment for the students to use. Part of the non-working equipment could still be traced back to the student responsibility issue mentioned by Mrs. Clayton. Despite this, she no longer mentioned it as a hindrance to technology use by the end of the study. Perhaps this is because of her ability to conduct class with strong classroom management skills.

How Technology Was Used in Mrs. Clayton's Classroom

As mentioned several times, Mrs. Clayton utilized a lot of technology when compared to other teachers on her campus. Her colleagues viewed her as one of the technology experts on their campus, one that they could go to with technology questions. Mrs. Clayton did, in fact, utilize various technologies in her classroom. She had a laptop computer, projector, and document camera that seemed to be standard in every teacher's classroom on this particular campus. She utilized an eInstruction® Interwrite™ Whiteboard and Mobi™ Board in her classroom on a daily basis. Texas Instruments® TI-Nspire™ calculators and CPS™ Student Response Systems were visible frequently in the hands of her students. While Mrs. Clayton used quite a bit of technology, she used it mostly to instruct the students, which makes her technology use mostly teacher-assisted.

In addition, she also had two student computers that were lined up on a single table toward the back of her classroom. The researcher rarely observed students using these computers, but Mrs. Clayton stated that the two computer stations were used "periodically [as] stations and just various Web 2.0 tools are used, um just to add excitement to the classroom" (Initial Interview). There was one additional computer in the room that Mrs. Clayton used as her teacher computer. She also had a printer in her classroom that was connected to all three of the classroom computers. Mrs. Clayton was issued a laptop computer and an Apple® iPad®. Her laptop was frequently observed connected to her projector and she occasionally was observed using the iPad connected to the projector.

Additionally, Mrs. Clayton used several of the web-based tools that were presented in Technology Tuesday trainings. For example, in order to introduce line plots

to the students, the student teacher used a Web 2.0 tool called Museum Box (museumbox.e2bn.org/). This tool is set up much like a display in a museum with various artifacts for students to see. Because it is a virtual tool, the user can add pictures, videos, and text to the display for others to explore. Other tools that were used by Mrs. Clayton included Fakebook (Facebook®-like website that allowed the users to enter all profiles and posts, http://www.classtools.net/FB/home-page), Poll Everywhere™ (online polling, http://www.polleverywhere.com), Today's Meet™ (collaborative discussion, https://todaysmeet.com), Popplet™ (collaborative mind-mapping, http://popplet.com), Glogster™ (virtual bulletin boards, http://www.glogster.com), and QR codes.

Mrs. Clayton also makes use of student cell phones in the classroom despite the district policy that prohibits them:

> You can definitely bring their cell phones, but I mean, I know there is a district policy about no cell phones being out, but I think that is only if it's an instructional barrier or obstacle, but if it aids instruction, I think they should be able to use it (Initial Interview).

While the researcher never witnessed her using the cell phones, in her final interview she commented that

> We've done QR codes with their cell phones, and then we've done apps on their cell phones, like there was an app on an iPhone for Pythagorean Theorem that you could download for free and so they used that and got in groups. So, we use cell phones in the classroom.

This shift from knowing that the district policy prohibited the use of cell phones to actually using them for instructional purposes is an interesting shift. Mrs. Clayton indicated that if the students were using them for educational purposes that she felt that they should be included. Mrs. Clayton did possess a rapport with her students that seemed to facilitate her being able to maintain control over her classrooms, which

probably made her feel like she could handle students using the phones in a productive and educational way.

Specific uses of her chosen technology, Edmodo™, Mrs. Clayton used several features in order to encourage her students' full participation. For example, Mrs. Clayton utilized notifications through the program. Students were able to enter either an email address or a phone number into their Edmodo™ profile. As the teacher, Mrs. Clayton could then notify students of upcoming tests and assignments through the program without having to enter or even knowing their email addresses or phone numbers. Mrs. Clayton went further than notifying students of tests, by sending out provoking thoughts that she then brought up during class in order to elicit discussion. She also notified students of topics that would be discussed in class that week. During training on April 18, she stated that students were fond of the notifications because they were able to know what they could expect when they came to class each day.

In addition to the notifications, Mrs. Clayton began using badges in Edmodo™ to encourage student participation. Badges could be assigned to any student for any reason. The badges, once assigned by the teacher, would show up on a student's profile for others in the class to see. Mrs. Clayton stated on April 18, that once she began using the "hard worker" badge to deserving students, other students became upset that they did not get one. According to Mrs. Clayton this increased student participation because every student wanted the badge for his or her profile.

Mrs. Clayton's use of technology from beginning to end of the study did not increase much, except for the introduction of Edmodo™, a few web-based tools, and cell phones in the classroom. Despite this, she continued to integrate technology in various

formats in order to keep her students engaged. One year after the conclusion of this study, the researcher asked Mrs. Clayton to list the technology she was using. The list was almost identical to the resources she had used during the course of the study. One may consider this to be either non-movement toward more technology, or proof that she enjoys technology because she was still integrating technology and did not backslide in her technology usage upon completion of the study.

Progress Toward Student-Centered Understanding

While Mrs. Clayton used quite a bit of technology, her use was still considered teacher-assistive technology because she used it mostly to instruct students. Even though she used most of her technology to deliver content to students, her interest in using Edmodo™ in order to give her students "24 constant access for the kids" and "a virtual classroom and one-to-one ratio" (Initial Interview) hinted at her desire to move her classroom toward more student-centered technology applications.

Frequently, Mrs. Clayton put the technology in the hands of her students, although it was still with a teacher directed focus. Students were using the Mobi™ Board and Interwrite™ Boards frequently, but always when directed by Mrs. Clayton and for the purpose of her planned lesson. At one point, Mrs. Clayton discussed the concern she had for her students which hinted at a reason she felt she could not turn them loose with the technology: "maybe there's too much for them that they do get overwhelmed with: use this, use this, ok we're using this today. Maybe if we could just find a way to simplify everything" (Initial Interview). It was interesting to consider that later in her answer to the same question, she said, "I don't think they would have a problem using technology every day at all. I mean, that's what they, this is a web generation." It was

conceivable that she felt students could benefit from technology but that her own students were not quite ready to be turned loose to make their own decisions regarding technology.

Mrs. Clayton did seem to desire to move her classroom toward student-centeredness. Originally, she stated that she wanted to use "more technology in [instruction] to actually have the kids practice so it's not pen and paper all the time." This idea of student-centered still contains much teacher direction and practice. During the creation of her first individualized professional development plan, Mrs. Clayton stated that she chose Edmodo™ because she wanted to offer,

> self-paced instruction to where assignments would be assigned on the Monday and then it would be due by a certain day and so they could sit there and work an assignment until they reached whatever grade they would like to achieve. And if one kid is struggling with integers, well then they can receive one-on-one help with the teacher in the room to help them through that while another kid who worked really well with integers can go ahead and move on.

This shift toward student-centered still would not necessarily give students control of when and how to use the technology, but would give them some control over the speed at which they covered the material.

As Mrs. Clayton progressed through the study, her ideologies about student-centeredness changed. This could be due to the training or her use of Edmodo™ that led to an understanding of how better she could utilize it with her students. Perhaps it was a combination of both issues at once. One example of how far she came with her student-centered ideology was her desire to utilize Edmodo™ to help her differentiate her instruction during class time. For example, during her third training session, where it was noted that she moved from Stage 2 (Teacher Preparation) to Stage 3 (Curricular Reform), Mrs. Clayton discussed the fact that she created two different quizzes over operations with fractions and percentages. She wanted to use the scores from those two quizzes in

order to individualize her instruction in class the following day. Her intention was that students would be placed in groups within the classroom to work on activities that were indicated by weakness on the Edmodo™ quiz. Another example of her student-centered thinking was evident in a conversation during training on May 1. During this conversation, Mrs. Clayton mentioned that she would really like to be able to incorporate Edmodo™ with the use of physical projects completed in class. This topic was actually discussed during several training times as Mrs. Clayton continued to search for ideas to help it be a successful integration of the web platform and physical classroom.

By the final interview session, Mrs. Clayton's understanding of a student-centered classroom had developed into a true student-centered definition. In response to what her ideal classroom would look like, Mrs. Clayton stated that it included her students being "able to use technology to create their own concept of what they are using, and to create their own authentic assessment of everything." This shift to a student-centered approach to technology is exactly what this study had hoped to encounter. The researcher did not observe Mrs. Clayton allowing technology to be used in such a way as she described above, but the idea implanted in her mind is a step in the right direction.

Professional Development Needs

Because Mrs. Clayton has a strong intrinsic locus of control (Rotter, 1966), she was able to function well with technology despite the professional development opportunities that she chose to attend or was required to attend. An example would be that Mrs. Clayton was observed using many of the technology tools that were presented to her in Technology Tuesday trainings. Even though she was able to utilize the tools presented in professional development opportunities, she possessed strong feelings about

the way technology was normally presented in these trainings. When asked how she felt about the traditional professional opportunities she had experienced in the past, she stated,

> Honestly, I'm not a fan of traditional professional development…Just because I don't agree with the fact that I have to go to the same training year after year and it's just re-runs of what I did the year before when there is too many things that I could be learning that I could implement into my classroom to better help my students. But apparently professional development is more along the lines of get what other people want done instead of what the teachers need to have done for themselves (Final Interview).

In contrast, the researcher asked Mrs. Clayton to discuss her feelings about the differentiated training she had just received, Mrs. Clayton stated,

> meeting that individual's needs. And, you know, helping them get from one point to the next instead of everybody's doing one thing to where if it was differentiated, then one person can go her, another person's doing this, and lots of needs are being met at one time to where you're not just stuck and go.

Despite her obvious preference in models, Mrs. Clayton was asked how both models might be improved and she was able to express that the traditional model could be better by incorporating differentiated elements into the trainings. She suggested using a survey of teacher interests and needs at the beginning and then offering two or three topics that teachers could choose from at each training session. Mrs. Clayton called this, "traditional but differentiated" (Final Interview). As for making differentiated trainings better, her comment was similar. She wanted it to begin earlier in the year and follow the same format as the training she received in this study except to be

> able to meet with people to discuss what is it that I need, or with maybe with a cohort of people that have the same needs as me, so that way we could bounce ideas off of each other and we could talk about just things we need.

Given her expressed disdain with traditional professional development models, it was significant that she included elements it can contain (collaboration, group learning) into

making the differentiated model better. Likewise, making the traditional model better included adding elements of the differentiated model.

Mrs. Clayton was asked how she might design her own professional development if given the opportunity. Her answer reflected her comments related to making each model better and also mirrored much of the training she received in this study. She built upon the individualized training plans instituted in this study by discussing several checks-and-balances in order to hold teachers accountable for getting enough quality training throughout the year. Perhaps this stemmed from an earlier comment she made referencing traditional professional development, "the general professional development plan we have in the district, I'm not a fan of." Her ideas included instituting benchmarks to keep teachers on track to get the correct amount of professional development required each year. Her plan included pre- and post-surveys in order to document progress with skills obtained through the trainings. She also suggested teachers being required to share their learning with each other when they received training. This would perpetuate the hybrid traditional/differentiated model as teachers continued to share with groups of interest rather than being forced into groups. This hybrid model included more of the differentiated model with collaboration from traditional models added.

Even one year following the study, the differentiated professional development model was still a priority for Mrs. Clayton, "I would like to see a plan that is tailored to each teacher and their needs. It is pointless to have training over a skill that you know, thus time is wasted." Despite being required to attend traditional professional development trainings, it was apparent that Mrs. Clayton still felt capable of and preferred to direct her own professional learning opportunities.

Follow-up Support Needs

Support from the researcher was not a critical component for Mrs. Clayton's abilities to use technology in her classroom. Very quickly, the researcher was able to identify that Mrs. Clayton rarely needed the support of a mentor in her process of implementing Edmodo™ with her students. During the very first training, the researcher noted that Mrs. Clayton "seems very comfortable with Edmodo™ and is utilizing the program effectively with her classes. She has full classes set up and has already begun assigning students assignments and homework through the site (Montgomery, DPD for TI Field Notes, April 10, 2012). Often, the training sessions were spent with Mrs. Clayton explaining how she had implemented Edmodo™ since the last meeting with the researcher, how it went, how the students were responding, and any issues she had faced. The researcher would generally take the issues that Mrs. Clayton mentioned, and would research them and the answers would become the beginning of the next training session. One month into the training, the researcher noted that he had

> realized that the support that [Mrs. Clayton] really needs in implementing this technology is simply someone to listen and bounce ideas off of. She does not seem to allow barriers to stop her from moving forward. I will continue to listen, ask questions, and give suggestions that are appropriate to support her usage of Edmodo (Montgomery, DPD for TI Field Notes, May 1, 2012).

In addition to not needing much support, Mrs. Clayton never made requests for just-in-time assistance throughout the study. Given the lack of requests, the researcher believed that the support offered to Mrs. Clayton was more of an accountability system for her. Because regularly scheduled meetings were occurring with Mrs. Clayton, she had reason to keep moving forward with her technology integration. This is especially sensible when considering that by the time the researcher conducted a follow-up

interview one year later, Mrs. Clayton stated that her barriers to technology use included, "lack of technological support from Instructional Specialists and lack of working desktops/laptops." It was clear by her comment that support for technology integration is no longer available to her and therefore has created a new barrier for her. It is interesting that despite her nature to tackle the technology until she hits a barrier that cannot be sidestepped, and the small role that support offered her during the study, that she now views lack of support as a barrier. There is no doubt that Mrs. Clayton can survive without the support; however, she may truly appreciate the safety net of having support just in case she needs it when integrating technology.

Mrs. Clayton's Conclusion

Mrs. Clayton is interested and willing to try various technologies in her classroom. She seemed to require it in order to feel like she was connecting to her students. During the course of the study, she searched out answers to her questions on her own, relying on the researcher's support as more of an accountability system.

Mrs. Clayton's technology aspirations. Mrs. Clayton desired to create more of a virtual classroom for her students. Offering resources to students twenty-four hours a day seemed to be very important to her. Mrs. Clayton was focused on using Edmodo™ with her students from the beginning of the study. As a matter-of-fact, the first training session following the development of her first individualized plan was already focused on things she had tried and was curious about related to Edmodo™. Because she had only selected the tool in the individualized plan, it was interesting that she wasted no time in getting the tool ready to use with students. This aspiration was so strong that even at the

end of the study, when asked to select a new technology that would be studied next if there were time left in the study, Mrs. Clayton chose Schoology™, a tool that is a competitor to Edmodo™.

Mrs. Clayton seemed competent in troubleshooting the technology she used in her classroom. On several occasions, the researcher observed her working on technology and if unable to fix it, she could easily substitute in another technology to take its' place. For this reason, troubleshooting issues seemed to not be an issue, however, she did indicate that she wanted to improve the skills that she felt she already possessed.

As the study progressed, she began to indicate that she would like to use Edmodo™ in more ways that might reflect student-centered uses. For example, she wanted to use quizzes to differentiate the instruction she provided, and wanted to determine a way to utilize the web-based Edmodo™ with physical projects in class. It is believed that as long as Mrs. Clayton continued to receive support from administrators as well as working equipment, that she would be able to continue progressing toward implementing Edmodo™ or some sort of virtual classroom in more student-centered ways.

Barriers to Mrs. Clayton's aspirations. Most of Mrs. Clayton's barriers stemmed from "if only" barriers, those outside her control, although an additional two could either be labeled "if only" or "what if" barriers. "If only" barriers can only be overcome if someone else does something first, such as provide access to technology to the teacher, apply less pressure for state mandated testing, or give the teacher additional time to explore a new technology.

For Mrs. Clayton, barriers that dealt with "if only" issues did not seem to stop her from integrating the technology. Normally a teacher with "if only" barriers would exhibit extrinsic locus of control as defined by Rotter (1966). On the contrary, Mrs. Clayton seemed to feel that a lot of her issues stemmed from what others needed to do, but she failed to wait around for them to take care of them. Instead, she would either figure it out, use the technology until the barrier became more than she could overcome, or simply figure out a way to sidestep the problem. Perhaps it is her young age, and the fact that she had graduated college just four years earlier. As part of the younger generation of teacher, she grew up during a time of technology booms which increased her ability to have access to technology as a student herself. These factors could explain her "can-do" attitude when integrating technology, despite barriers she faced.

For one particular barrier, the prohibition of cell phones in the classroom, she felt strongly that she could control the educational benefits of the cell phones and proceeded to utilize them in her classroom. This would be explained by her younger age, especially because she most likely relied heavily on her cell phone during her own days as a student in college. If that was the case, it would be easier for her to see the education impacts that cell phones could have on her students.

How technology was used in Mrs. Clayton's classroom. Mrs. Clayton utilized various technologies in her classroom almost daily. With the exception of cell phones, Edmodo™, and a few web-based tools introduced in Technology Tuesday trainings, she continued to use the same technology throughout the study. Her use of web-based tools was varied and was aimed at keeping the students engaged in the lesson and activities of that class period. Her development of new ideas for using Edmodo™ did evolve over the

course of the study. Perhaps ideas flowed more freely the more Mrs. Clayton used Edmodo™. This would make sense; given the fact that her purpose for selecting it as a tool to study was to evaluate its effectiveness with her students. As she saw the educational value for her students, she began to identify more ways to use Edmodo to reach her curricular expectations.

Progress toward student-centered understanding. Mrs. Clayton showed hints of student-centered thinking as early as the initial interview when she stated that she wanted to give her students access to curricular materials twenty-four hours a day. This would allow them to be able to access any part of the material that they did not understand as many times as they needed in order to master the skill. While this was not a true definition of student-centered, it did show her desire to differentiate to make sure that all of her students could be successful. It did show a critical first-step toward student-centered learning, since she desired to make sure that each student can get what he or she needed to be successful in her classroom.

Throughout the study, her implementation of Edmodo™ drew her closer to the definition of student-centeredness. As she explored using Edmodo™ quizzes as a way to group students based on their understandings, she eventually came to the conclusion that Edmodo™ could assist her in allowing students to create their own authentic assessments. Added to that desire, she hoped to integrate Edmodo™ into classroom activities, like projects, more seamlessly.

Mrs. Clayton's beliefs about student-centeredness developed as hoped. The researcher believed that she will continue to move toward that end as long as her access

to technology remains constant or improves and she receives continued support from administrators and other faculty that realize the importance of technology integration.

Professional development needs. Mrs. Claytons' professional development opportunities should be differentiated in some format in order to meet her needs. Traditional professional development opportunities are perceived, by Mrs. Clayton, as a waste of time, especially if the topic is one she already feels confident about. A group of like-minded professionals with similar aspirations would meet her needs much better. If given the opportunity to direct her own learning, Mrs. Clayton would be a teacher who would use the opportunity to get the most out of her choices, and not squander her time. She would seek out important topics that she could implement into her lessons. Professional development opportunities should also have practical uses for Mrs. Clayton since selling her on why she should use the technology will not be necessary.

Follow-up support needs. As for follow-up support, the researcher believes that this was a critical piece of the model that Mrs. Clayton experienced, even though she did not use the researcher in a support role; rather she used the support as more of accountability for her to continue to study the technology. As mentioned previously, a group of like-minded professionals with similar aspirations would be able to fulfill this need for Mrs. Clayton. The researcher believed that Mrs. Clayton will thrive with technology with or without professional development opportunities, but the support system she needs is important to her for her continued growth.

Case Study: Ann Evans

Mrs. Evans Introduced

Ann Evans (pseudonym) is a Caucasian female in her thirties. She had eight years of teaching experience, all within the content of science. Five of her eight years had been in high school, and the last three had been in her current position as an eighth grade science teacher. In her classroom, content was delivered mainly through the avenues of lectures and state-mandated science labs. In the state of Texas, it was a requirement of middle school teachers to allow forty percent of their class time to be hands-on labs for students to complete (Texas Education Agency, 2009). During her lectures, she occasionally showed videos or displays a PowerPoint so that her students could copy down important information into their journals. Labs were hands-on activities that demonstrated content that was being studied in the lectures. Typically students worked independently during lecture and work times, and in groups during lab times.

Mrs. Evans's classroom was set up into three major student sections. Section one was near the front of the room where she conducted her lectures. Her projector and document camera were set up in this area and pointed toward the whiteboard. Several straight rows of student desks faced the whiteboard.

The second section ran along the right side of the room and consisted of lab stations. There were several stations available, each with a large tabletop, a sink and several stools. In classes where there were not enough chairs in the main section for all students to sit, this area served as additional seating during lectures.

The final student section was a large round table in the back of the room near three desktop computers. Here six to eight students could sit and work together if

necessary. The researcher observed that this was where Special Education students sat with an Instructional Aide. In this manner, the Aide was able to assist the student without disturbing the remainder of the class. This section was also used for students to sit when there was not enough chairs in the main section.

Mrs. Evans was not a timid teacher, especially when she needed assistance. She was not afraid to ask questions, and demand, in a very polite way, attention when she needed or wanted help with something, technology or other. She possessed a desire to "get better at technology with [researcher as mentor] assistance" (Initial Interview) which she stated was her reasons for agreeing to become a participant in this study.

Mrs. Evans originally scored in the Early Technology category of the Technology Self-Assessment Tool (TSAT), missing Developing by not checking that she could do one of the statements. After careful consideration of this statement, the researcher dropped it from consideration based on the content of the questions (UDL). Because of this, Mrs. Evans was moved up to the Developing category and became eligible for participation.

Mrs. Evans's campus was in a unique place for teachers willing to integrate technology: technology integration encouraged by the administrations, support of Instructional Specialists, and access to various technologies. Having these factors in place helped eliminate several key barriers for teachers, such as lack of access to technology, unsupportive school culture, lack of support, and professional development goals, when implementing technology, (Hixon & Buckenmeyer, 2009; Hew & Brush, 2007).

Mrs. Evans's Technology Aspirations

Once these barriers were overcome, Mrs. Evans was free to dream big with regard to how she wanted to implement technology in her classroom. It was apparent that Mrs. Evans wanted to utilize more technology in her lessons. She desired to learn more about the technology she had access to and also wanted to integrate some of the Web 2.0 tools she had heard presented during the weekly Technology Tuesday training sessions. She wanted to use those Web 2.0 tools because it would get the kids' attention. She stated, "I really like the [web resource] where the robot talked, um, things like that, I think the kids just love. You know, just a little bit of cheese and they think it is the best thing ever" (Initial Interview). Mrs. Evans felt that connecting with her students through technology would be a powerful way to enhance learning in her classroom. Even though she wanted to get their attention, Mrs. Evans felt that whatever technology she used should also support her science content and not be just for show. For instance, she wanted technology that would allow her "to do test practice with the children" (1st Individualized PD Plan Meeting). Ensuring that technology supports content is a commendable use of technology.

These findings are consistent with the aspirations that Mrs. Evans expressed during her initial interview. While the researcher never directly asked Mrs. Evans what she wanted to be able to accomplish with regard to technology, her responses to other questions highlighted the following six desires:

1. Identify technology that is available for use in her classroom
2. Be supported in class when implementing technology in lessons
3. Use student computers in her classroom as station activities that students can rotate through

4. Use Interactive Whiteboard for games or challenges
5. Increase her ability to interactive with students by being more mobile and students interacting more with the technology instead of Mrs. Evans
6. Make time to learn enough to use technologies in her classroom

Mrs. Evans's own comfort level with technology formed the basis of all these barriers. This observation is significant given that she desired for the technology to support her content and not be something just added to make it flashy. Perhaps Mrs. Evans is unable to visualize what integrating the technology might do because she is too focused on her own inabilities with the technology. This idea is supported by her response when asked what essential technological skills teachers must have. For teachers her ideas for essential skills shifted from knowing how to implement technology effectively to having some confidence and familiarity. The researcher found it interesting that her initial answer sounded more like she believed teachers needed to know a lot about the technology to use it with students. She stated that most important for a teacher was "being comfortable with technology, then knowing how to implement it in its most useful way." In her final interview statement she sounded more like she believed the teacher needed to just be comfortable having technology available and knowing some of the functionality so that they would know what it was capable of doing:

> I think you can't have just used it once or watched somebody else use it. I think, you know, you kinda (sic) have to play with it so that you at least know what some of the limitations might be or some of the errors that can arise and let it overwhelm you or scare you off the equipment.

By this statement, it would seem that Mrs. Evans believed that being knowledgeable about issues that might arise was more important than knowing everything about how the technology works.

Mrs. Evans chose the eInstruction® Interwrite™ Board to study during the course of this study. As stated earlier, she chose this tool to study because she wanted "a piece of equipment that's going to allow me to do test practice with the children" (1st Individualized PD Plan Meeting). This choice was most likely due to the fact that the state-mandated science test would be given a few weeks later and test preparation was what Mrs. Evans was focusing on in her classes at the time. Even though she would have used it to focus on test prep, she did want to make sure it was more interactive for the students.

> We could do games and do activities where we're still doing test questions and responses but they're interactive, and then the technology truly is in their hands. It's not me just walking behind them with the Mobi and being mobile.

It was impressive that Mrs. Evans chose a technology that she had no previous familiarity with, and had never had access to before the study. This intrinsic locus of control (Rotter, 1966) allowed her to step out of her comfort zone and take on a completely new technology genre than Mrs. Evans had ever experienced before.

Barriers to Mrs. Evans's Aspirations

Mrs. Evans demonstrated a desire to learn about technology but also did not view herself as strong with technology, and therefore needed assistance from the Instructional Specialists on campus when she wanted to integrate technology. Because of this, she faced numerous barriers to technology integration. As a matter-of-fact, her barriers were so strong, that she was implementing little technology beyond her projector, document camera, and laptop computer. As might be expected for a timid technology user, Mrs. Evans faced more "if only" barriers, those barriers outside of Mrs. Evans's control. Connected to Rotter's (1966) locus of control framework, these barriers relate to a

teacher's ability to use technology "if only" someone else would fix the hindrances, such as access, school culture, provided support, mandated testing, professional development goals, and provided time to plan. Because most of her barriers were "if only" barriers, it seemed that Mrs. Evans had a higher extrinsic locus of control. Because of this, she was unable to integrate technology until someone else created a pathway through her barriers, thereby making integration easier for her. What was interesting was her belief that even though those barriers stopped her from being able to use technology, she should not let them. At one point in the initial interview, she disagreed with a statement that indicated that she did not have enough time to learn how to use the technology, stating, "I guess I am going to have to disagree or else I wouldn't have signed up to be part of your study. Because I mean, I want, I want to make time." She also disagreed with a statement that asked if technical problems could interfere with her instruction by saying, "Everything interferes." These statements indicated that she knew the barriers keep her from integrating, but did not feel like she should use them as an excuse.

Mrs. Evans listed nine barriers, six of which could be tied to her extrinsic locus of control (Rotter, 1966) or "if only" barriers. These barriers included:

1. Time – Hands-on time was important for Mrs. Evans to feel like she could master a technology. She also discussed that it would take time to build and implement effective lessons. For this reason, she felt that it would be easier for her to learn more about technology when she was able to teach the same content for more than one year in a row.

2. Access – Mrs. Evans's discussed concerns about sharing and failing equipment across the building. She felt that without the technology in her classroom where she could see it often, she would be less likely to remember that it was available.

3. School Culture – Mrs. Evans indicated some concern for student accountability, not with the equipment, but in trusting the students to do what was right on the technology when Mrs. Evans was not able to watch them.

4. Support – Needing support from Instructional Specialists during the development and implementation of technology infused activities was important to Mrs. Evans.

5. Testing/Assessment/Accountability – Mrs. Evans addressed testing requirements similar to any other barriers that she would face when implementing anything new into her classroom.

6. Professional Development Goals – Mrs. Evans indicated that she would like to be able to implement ideas presented in trainings but that she is often left wondering exactly how she could apply it in one of her lessons.

Mrs. Evans also dealt with three additional "what if" barriers. This type of barrier deals with issues that lie within the control of the teacher and are typically phrased as "what if" something happens, what will I do? As stated earlier, these "what if" barriers fit within the intrinsic locus of control as defined by Rotter (1966), because these barriers deal with Mrs. Evans's own intrinsic motivations. Examples of "what if" barriers include attitude (Hixon & Buckenmeyer, 2009; Hew & Brush, 2007), interest (Neiderhauser & Perkman, 2008), time (to learn, play, and apply the technology to a lesson) (Hixon & Buckenmeyer; 2009; Hew & Brush, 2007), knowledge and skills (knowledge of how to use one technology) (Hixon & Buckenmeyer, 2009; Hew & Brush, 2007), and ability (capability to transfer knowledge of one technology to a similar technology) (Velazquez, 2007). For example, one of her "what if" barriers dealt with her attitude regarding the use of the technology. Mrs. Evans discussed needing to feel ownership of the technology in order to have more confidence in using it with her students. She also discussed technology needing to be less of the main focus and more of a tool for students to learn the content of science. Additionally, she felt that she needed to ask for help in order to be able to accomplish what she would like to with technology. Additional "what if" barriers affected by her extrinsic locus of control (Rotter, 1966) include:

1. Knowledge & Skills – Mrs. Evans was concerned about making sure she was comfortable with the use of technology as well as knowing more than the kids in order to help make technology use more effective.

2. Ability – The ability to work her students through transitions when utilizing technology integrated with other activities was of concern for Mrs. Evans.

One issue that Mrs. Evans spoke about frequently included the concern for the purpose of technology use in her classroom, specifically desiring for it to be content supportive and not used as a reward system. For her, technology should be used to learn the content of science and not just something flashy in order to gain the students' attention. For this reason, she was concerned with how it was being integrated and how it was affecting the students when used. Initially, she expected her students to struggle with transitioning from various activities in her classroom. Because technology could be more fun and entertaining for the students to work with, she worried that she would have problems with students working on tasks that did not involve technology because they were not as much fun. In the final interview, her concern shifted to more of what kind of student she was helping to produce.

> They come in your room and you know, you're doing all technology-driven and everything's somewhat entertaining to them while being educational, they go into another room and it's like, 'Well, where's your technology?' You'd have to consider that a problem because they really do thrive on that and they come to expect things and they're real quick to compare one teacher to another.

This comparison concern could result in pressure from other teachers for Mrs. Evans to stop integrating, or could cause issues with connections between teachers and students even though she feels that connections were being made through technology use. Most likely she is not as concerned about the pressure from other teachers to stop her integration because she wished other teachers would step out of their comfort zone and try things because the technology could help with connections to students. For Mrs.

Evans, using technology could increase her "ability to interact with [my students]" (Initial Interview).

Mrs. Evans also seemed to be crippled by the barrier of state-mandated testing, especially as the study progressed. As stated previously, she wanted to use tools that would allow her to "do test practice with the children" (1st Individualized PD Plan Meeting). On May 10, she stated that she was having fun with the integration of the Interwrite™ Board but that her usage had waned since the first weeks of training. According to her, she was on fire in the beginning but had since hit a plateau because of state-mandated testing and other campus requirements that surround the end of a school year. As a matter-of-fact, Mrs. Evans was off campus for two days (May 14 and 15) for additional professional development trainings. On May 17, the researcher met with Mrs. Evans and noticed that the Interwrite™ Board was no longer in her classroom. She stated that she had removed it when she was going to be gone because she did not want to lose any parts. She had yet to retrieve it from the storage location. Despite this, she continued to discuss activities that she had done and was planning to continue to do with the Interwrite™ Board.

While most directly tied to her barrier of state-mandated testing pressure, the fact that she removed the Interwrite™ Board from her classroom and had not retrieved it several days after returning to campus, speaks to two additional barriers that she faced. The first is the student accountability of technology on her campus. She struggled with trusting students to work when she could not be directly monitoring them while she was in class. By removing the Interwrite™ Board when she could not be in class indicated that she felt like she could not trust a substitute teacher to monitor the students and

without that monitoring, parts of the equipment might disappear or become destroyed. The second additional barrier related to the removal of the Interwrite™ Board was the period of time where support from a mentor, like the researcher, was not available. Testing and teacher absences kept the training meetings from happening. Because her barriers were related to her extrinsic locus of control (Rotter, 1966), it was not surprising how important the support of a mentor was to Mrs. Evans's abilities to integrate technology.

With the promise of support from the researcher, as well as participation in this study, Mrs. Evans was able to immediately begin overcoming some of her "if only" barriers. For instance, once access to the Interwrite™ Board was given, along with a small amount of general training on how to use it, she immediately began searching out resources and using them with her classes. As a matter-of-fact, she received the Interwrite™ Board in her classroom on April 10, and on April 11 she had used it to display websites for her students and allowed her students to interact with activities she had found on the Internet. This would indicate her strong interest in using technology, but also as she stated in reference to selecting the Interwrite™ Board as her technology to study, she had "never used it" but that she felt she was "highly capable" of learning.

How Technology Was Used in Mrs. Evans's Classroom

Mrs. Evans utilized very little technology prior to the beginning of this study. Although she had the traditional technology set-up for her campus, projector, laptop computer, and document camera, she utilized little else. She did have several student computers set-up in the back of her classroom, and states that, "I'd like my class to have

more centers" (Final Interview). This desire became her choice to study should she finish with an entire cycle of Kopcha's (2010) model focusing on the Interwrite™ Board.

The researcher observed Mrs. Evans utilizing two additional technologies, on a piece of software, and the other a web-based program, with her students on several occasions. The software was displayed using her laptop computer and projector so that the class could easily see. The first was a Microsoft® PowerPoint® presentation on how to read a graduated cylinder during a science lab. Later in the training sessions, she wanted to integrate her Microsoft® PowerPoint® presentations with the Interwrite™ Board so that she could annotate on her PowerPoint® slides.

The second technology, eduSmart™ Science, was a simulation web-based program that demonstrated various concepts of the science curriculum. Mrs. Evans explained eduSmart® Science software like this,

> We have a program called eduSmart™ that I use weekly, everytime we do a new topic we watch it. It's interactive, or has questions that pauses and then they watch and it is kinda (sic) based on Texas and environments and such. And so there is one over simple machines, and they go out in the field and they move crates of apples. And they talk about using pulleys. And so it just introduces a concept and it's these familiar characters, and they work in Texas or do their activity in Texas, and it addresses the [state objectives] specifically (Initial Interview).

Even though it was a simulation program, Mrs. Evans used it as a class activity. She had one student work the computer by clicking the next button or answering the questions after the class as a whole decided on the correct answer. Mrs. Evans frequently asked the student running the program to select pause so that she could conduct a class discussion on the topic being introduced in the simulation.

Mrs. Evans' list of technology she used did not change significantly from initial to final interview. Her ideas of how to utilize those technologies in her classroom did

change, however. Of significant interest to the researcher was the fact that in the final interview, Mrs. Evans listed several teachers on campus that she had visited with about how they were using these technologies in their classrooms. This is a critical component of Kopcha's (2010) model for teachers to be able to do; to reach out to others for ideas and support during the implementation of technology.

While her stated list of technologies did not change, additional data collected showed otherwise. During the course of the study, posts submitted by participants to the campus blog were collected. Mrs. Evans posted once during the month prior to her initial interview. This post detailed how she used the student response clickers to give a unit test. In her post she states, "The CLICKERS rock I will use them often" (Blog Post, January 24, 2012). Two months later, she posted once more, this time about allowing her students to use Glogster™ (http://edu.glogster.com) to create an online poster about an ecosystem that they researched in the library. "They caught on super-fast and created great products" (Blog Post, April 1, 2012).

Both of the above posts occurred prior to the one-on-one training that Mrs. Evans received during this study. Once those trainings started, Mrs. Evans posted several times on the school blog. As a matter-of-fact, the next month of blog posts contained six individual posts from Mrs. Evans, and nine posts where she partnered with another science teacher for technology activities. Of the fifteen total posts, ten were posts about ways that Mrs. Evans was integrating the Interwrite™ Board into her classroom. The other five topics included using digital comic strips to create content, watching science videos, using the Internet for research, utilizing a digital microscope that displayed on the board, and using the CPS™ Student Response System.

Even though there were a large number of posts, five activities all related to a crime scene investigator simulation activity that Mrs. Evans had found for use with her Interwrite™ Board. She and her partner teacher simply explained five separate activities that students were working on within that unit. These included analyzing stomach contents, blood spatter, trace evidence, fingerprints and identifying characteristics for good witnesses at trial. One of the activities was more student-centered in that the two teachers (Mrs. Evans and her teaching partner) allowed students to create something that showed their own understanding of content. This included allowing students to create a comic strip using a digital tool such as Bitstrips™ (http://bitstrips.com/create/comic) to make a book of cells and cell parts.

Progress Toward Student-Centered Understanding

As previously discussed, Mrs. Evans felt very strongly that technology should be used to supplement her content rather than be used to grab students attention. She certainly used technology in such a way as to deliver her content, making it teacher assistive technology. When using eduSmart™ Science, she allowed a student to control the computer, and therefore the simulation, but she directed them as to what to do and when to pause for discussion.

Mrs. Evans exhibited a shift in student-centered ideology early on in the trainings. From the very second training, she was already discussing allowing students to control the technology rather than the teacher. On April 11, she explained that she allowed students to work through an interactive activity on the Interactive Board while she sat in the back of the room and observed. By May 10, she was using an activity that she found that allowed her students simulate being a Crime Scene Investigator. This activity had

students collecting evidence, analyzing it under a microscope, and piecing clues together to determine who committed the crime. She also envisioned allowing students to build digital products to showcase their learning, a true student-centered activity.

A strong indication of her development of student-centered thinking came in the final interview, when she listed several technologies that she uses and approximately how many days she uses them. Following this discussion, she made a statement that led the researcher to believe that she was shifting her thinking about technology to more student-centered. "And that would almost be a silly question because do I use technology or is technology in the hands of the students? Because you know, [administrators doing evaluations] ask you that or they rate you on that, but it doesn't really count that your document camera is on, it only counts when it is in the hands of the children." This statement would indicate that Mrs. Evans's understanding of student-centered technology progressed along with her use of technology in her classroom.

Mrs. Evans's beliefs about student-centered technology are strong, yet she is making small, but consistent, progress toward its implementation. As previously reported, she desired that other teachers would step out of their comfort zones and try to implement technology. She feared that most teachers simply viewed technology as a way to get students to engaged, rather than interact with the content. Her strong focus on using technology to strengthen her curriculum attests to the fact that she understands that technology's purpose is not to simply engage the student, but to assist them in understanding, making connections to, and applying the content. She explained this by stating,

> Technology is just, it almost seems like you got your cake and that's just an icing. You know, technology's just gonna (sic) make your lesson better. So if you're

> busy just trying to make the cake, do you really have time to get to that icing? And I think that's one thing that you'all (sic) have done a good job of this year, is trying to say it's not the icing, it's the flavor, and your cake's really no good without it (Initial Interview).

By this statement, Mrs. Evans's understanding of student-centeredness is extremely strong, yet her technology barriers have prevented her from capitalizing on her beliefs.

Professional Development Needs

In order to overcome her barriers and reach her aspirations, Mrs. Evans needs a targeted professional development plan that can address her specific needs and support her with implementation. During this study, her technology uses did not extend past what she observed in Technology Tuesday trainings and the differentiated professional development plan instituted by this study. The traditional professional development training for technology that she had received in Technology Tuesdays was just leaving her frustrated by failing to meet her specific needs. She stated,

> Technology Tuesdays exposes us to [technology], but there is still a real barrier between bridging that gap because you see the same five people that are comfortable with it taking that information and going somewhere with it and the rest of us are, 'wow, that's cool, what would I do with that' (Initial Interview)?

Her frustration, seen in this quote, indicates that she does see where the traditional model of professional development is failing her specifically because it fails to provide her follow-up support. She saw benefit in a more specific professional development, like was conducted in this study, because she stated that she signed up for the study "to get better at technology with your assistance" (Initial Interview). This indicated that she desired someone to support her implementation because she did not feel capable of overcoming her barriers on her own.

During the course of this study, Mrs. Evans experienced both traditional professional development (Technology Tuesdays and other district-based trainings) and a differentiated professional development (this study). In the final interview, the researcher asked Mrs. Evans to discuss what elements of both traditional and differentiated professional development that she found most useful. Regarding the differentiated training she had received during this study, she stated

> The fact that I got everything that I wanted. Um, that fact that I, the plan was specific to me, and it met my goals, and I said what I wanted and we actually worked through what skills I needed to be successful with that, and then continued to build those skills. It wasn't just, 'OK, you know how to calibrate [the Interwrite™ Board], here's some ideas." Once we reached those goals we continued to build on them and I thought that was really impressive.

She also found some benefits to traditional professional development training, stating, "The traditional of it gives you the exposure, whether it helps you implement it, usually not, but it does allow you to see there's bigger and better things out there."

Mrs. Evans was asked what she thought could make a traditional training better, and she responded by discussing why many teachers struggle to implement technology following traditional professional development opportunities. "It is just enough time to be exposed, there's not enough time for you to actually experience it," and "I think a lot of people walk away feeling like, 'Oh, that's not for me. They just want us to know about it.'" From her answer, the researcher felt that for Mrs. Evans, more time, and more focus on implementation would make traditional trainings better. She was also asked how to make a differentiated training better and she responded, "If everyone got it. That's what would make it more effective. I mean, it's been, like I said, very beneficial for me" (Final Interview).

Despite such negative comments about traditional professional development, Mrs. Evans still indicated that it was helpful to her and that she wanted it to be a part of her ideal professional development.

> I guess like I'd want to be exposed to new technology maybe like on early release day. And then I would want to be able to talk to someone that could help me utilize the equipment that I'm already familiar with and find out what new things are available or address the concerns that I have with the technology I use (Final Interview)

Introducing new technologies in a traditional setting, followed by differentiated training for implementation seems to be what Mrs. Evans wanted in a personal professional development plan.

One year following the study, the researcher contacted Mrs. Evans and inquired about her technology use. When asked what professional development she had participated in during the year, she indicated that the school had provided no professional development for technology integration at all during the year. In responding to a question about how a lack of professional development impacted her technology integration, she stated, "They had SQUASHED it!!!!!!!!!!!" This is indicative of the fact that Mrs. Evans needs professional development opportunities with follow-up support in order to continue with her quest for the student-centered technology classroom.

Follow-Up Support Needs

Support may have been the most critical piece of the professional development plan for Mrs. Evans. Mrs. Evans indicates in her initial interview that she was comfortable asking for assistance from the campus Instructional Specialist when she wants to integrate technology, stating, "I feel like I can call, I know your extension, and magic happens when I do. So it's really beneficial. I mean, it's nice to feel like its'

really realistic and not just a 'you should be using it,' kind of a pipe dream thing." Her attitude about requesting assistance was further explained by her belief that,

> I don't really think that it's realistic to assume that you'all (sic) are just gonna (sic) just show up at the doorstep and say, 'I'm here to help you, let's do something great!' if there is no request made, and you have no idea what I am teaching or what I think great is.

Despite this comfort level, the implementation of technology was not happening in her classroom until a specific plan for training and follow-up support was initiated through this study. Once an individualized professional development plan was in place, she took full advantage of having the support of the researcher. At one point, Mrs. Evans requested to move a training scheduled for April 19 to the previous day because of issues with her lesson that she wanted to understand before implementing them the next day. Often, training sessions were dictated by Mrs. Evans's questions, concerns, and aspirations with the Interwrite™ Board.

Support became a crucial barrier for Mrs. Evans, when in the course of a couple of weeks, training meetings had to be cancelled because of state-mandated testing, and absences on the part of Mrs. Evans. As discussed earlier, during this time, Mrs. Evans's use of the Interwrite™ Board waned significantly. Without the constant support of the researcher, Mrs. Evans was unable to continue her progress with the tool. This indicated that Mrs. Evans's reliance upon the follow-up support was the most crucial piece of her individualized professional development plan.

Building a community of practice, a group of teachers that could assist her with implementation, was also important for not only the Kopcha (2010) model, but also for Mrs. Evans. The researcher created a page for Mrs. Evans on his website (http://www.scholastech.net/community-of-practice.html) with resources to Interwrite™

Board activities and lesson plan ideas. Albeit short, the list was meant to connect her with others on the web that could provide her with assistance when the study concluded. Prior to providing Mrs. Evans with this website, she had sought out teachers on her own campus to see how they were using technologies in their classrooms. This is a critical piece for teachers to be able to do; to reach out to others for ideas and support during the implementation of technology, thereby creating their own community of practice. Perhaps given enough time, her community would grow and be able to replace her need for support given by the researcher. It is unlikely that she was near the point of being able to continue her growth with technology outside the confines of her individualized professional development plan, especially since her technology integration had reverted to what it was prior to this study when in the next school year she received no professional development training or support in technology integration.

Mrs. Evans's Conclusion

Mrs. Evans was very eager to have an individualized professional development plan for technology integration. She was never afraid to ask for assistance when needed but had not put a focus on her technology integration in her classroom due to her "if only" barriers. Without the support given in this study, it is doubtful that Mrs. Evans would have made progress moving toward implementing her student-centered ideology.

Mrs. Evans's technology aspirations. Mrs. Evans believed that technology would allow her to connect to her students in a way she had been unable to do without technology. She was also convinced that technology must be utilized in a way that would help her perpetuate her curriculum, and believed strongly that technology used just to

grab the attention of students was useless. While a few of her aspirations related to her own knowledge and skills with the technology she had available to her, most of them focused on creating a more enjoyable, engaging, and successful atmosphere for her students to learn science content. The researcher found it interesting that she chose the Interwrite™ Board as her chosen tool of study, given that she had no prior experience with it and had not previously had access to one. This indicated that the impact of an individualized professional development plan was able to connect with her intrinsic locus of control (Rotter, 1966), or her desire to take risks. Of course, it should be noted that she was able to take these risks only after the study began, indicating that support was crucial for her to tap into her intrinsic locus of control.

Barriers to Mrs. Evans's aspirations. Mrs. Evans faced numerous barriers when trying to implement technology into her classroom. Most of her barriers were "if only" barriers, those that had to be fixed by someone else in order for her to be able to implement technology. Because these barriers were so difficult for her, she was unable to move forward at all with technology integration. As a result, she utilized little technology in her classroom prior to this study.

Mrs. Evans also faced a couple of "what if" barriers, those that deal with her intrinsic locus of control (Rotter, 1966). These barriers are issues that are within the control of Mrs. Evans, such as her knowledge and skills (Hixon & Buckenmeyer, 2009; Hew & Brush, 2007) of any particular technology. In the case of this particular study, Mrs. Evans had little to no knowledge and skills related to the Interwrite™ Board that she chose to study.

Many barriers of a non-technology user, like Mrs. Evans, do not seem to plague her, such as time (Hixon & Buckenmeyer, 2009; Hew & Brush, 2007), attitude (Hixon & Buckenmeyer, 2009; Hew & Brush, 2007), and interest (Neiderhauser & Perkman, 2008). She indicated that she wanted to make time to learn more about the technology, which is why she originally signed up as a possible participant in the study.

Mrs. Evans's "if only" barriers were easily overcome by her as soon as she was selected as a participant for this study. As a matter-of-fact, once the access to the Interwrite™ Board was overcome, she immediately began utilizing it with her students. It was as if she was ready to run as soon as the gate was opened. Once this barrier was taken care of, it seemed that her other barriers were fixed by simply providing the support of a mentor throughout the study process. When the researcher was working with her regularly, she made progress. But as already discussed, when other issues got in the way of regular training sessions, her use of the Interwrite™ Board waned. It is predicted that Mrs. Evans could continue to make progress with support. Because she created her own community of practice by talking to other teachers on campus about their technology use, she may eventually be able to function with technology when the support of a mentor is not constant.

How technology was used in Mrs. Evans's classroom. Prior to this study, Mrs. Evans's technology use was minimal, at best. She desired to use technologies with her students, especially to help connect them to deeper understandings of science content, but various barriers were keeping her from knowing where to start with implementation. As regular trainings continued, Mrs. Evans continually searched for and applied different activities and lessons she found for her Interwrite™ Board. She also began documenting,

on the campus blog, new web-based technologies that she was hearing about in Technology Tuesdays. This is of significance given she originally felt lost in those trainings because she was not sure how she might apply those technologies to her classroom. This would indicate that through the support she felt, she was willing to take more risks in technology, which led to more ideas and applications that she could make.

Progress toward student-centered understanding. From the beginning, Mrs. Evans indicated a belief in student-centered learning with technology. She repeatedly expressed the desire for her technology use to help students "obtain science material and not just have a good time." By the final interview, she expressed that in order for technology to be used effectively, it should be in the hands of the students. In addition, she felt that the content should be the focus along with technology as a tool to obtain science understanding.

Another indication of her progress toward student-centered understanding came in a discussion about the resources she was searching for and finding online for use with her Interwrite™ Board. Regarding the time she was using to find such resources, she stated,

> I would say probably four hours I could build something, but then again, you know, it could take me two hours just to hunt something down. You know how that goes, you can get on [the Internet] and you're going to find what you want and then you spent enough time that you could have built it by the time you finish hunting (Final Interview).

Additionally, she stated that the only thing she needed to assist her in being better at using technology in instruction was time to "start building lessons." These statements would indicate that Mrs. Evans was seeing the benefits to creating resources that were closely aligned with what her students needed. The researcher believed that, while this could still be a teacher-assistive approach, Mrs. Evans true desire was to create resources

that were more targeted for her students' use. Her willingness to take more time to build resources that were more fitting for her content rather than rely on already created materials indicated that she was moving toward a focus on her students' needs rather than simply getting her content covered. The researcher believed that this was where Mrs. Evans is beginning to put her student-centered ideology into practice in her classroom.

Further proof of her movement toward student-centered technology was her choice for her second technology, which would have been studied had she completed the entire Kopcha (2010) model with the Interwrite™ Board. For her second technology, she chose to use her classroom computers as stations that she could rotate students through during the course of a class period. She specifically wanted to utilize them in order to create stations allowing her to differentiate her instruction for her students. In addition, she wanted to use the computers in order to implement various Web 2.0 tools she had been hearing about in conversations with other teachers on campus and in Technology Tuesday trainings. She envisioned the use of the Web 2.0 as being a way of allowing students to build digital products to showcase their learning, a student-centered activity.

Professional development needs. Mrs. Evans would benefit from a differentiated professional development model with sustained follow-up support during implementation. She had stated concern about feeling lost in traditional professional development trainings because she was not sure how she could apply what was presented to her in that format. As seen in this study, without the constant follow-up support of a mentor, Mrs. Evans is likely to cease making progress toward her student-centered ideology. If provided follow-up support to help her implement what she has learned, Mrs. Evans may

be able to benefit some from a traditional professional development model, although she states that she prefers the differentiated model.

Follow-up support needs. As previously noted, follow-up support is perhaps the single most important piece of the differentiated professional development model for Mrs. Evans. Aside from providing access to the technology she wanted to study, the support she felt from the mentor was all she needed to be able to begin to overcome other barriers to her integration. For her continued progress, it is imperative that Mrs. Evans has access to support during implementation. Because she sought out a community of practice on her own, she may be able to rely on those colleagues as her support only after she increases her comfort level with the technology. The community of practice was not enough to keep her moving forward in her implementation, but may be enough after she feels like she has mastered the technology.

Cross-Case Analysis

Reflecting on the study participants, it was clear that the three teachers, while all on faculty at the same school and two in the same department, were all very different from each other in regard to their technology abilities. All three scored in the Developing category of the TSAT, and all three scored there by virtue of questions being dropped from consideration. They were all receiving the same traditional professional development trainings created for their campus and delivered weekly. Despite this seemingly level technological playing field, the three teachers exhibited markedly different abilities when it came to the technology they had access to on their campus.

Mrs. Cummings and Mrs. Evans were both teachers who utilized very little technology in their classrooms. They both stated that they wanted to be a part of the study in order to improve with technology. Mrs. Clayton was viewed as a technology teacher leader on campus, one who used a lot of technology and was regularly sought out by other staff members for assistance.

Technology Aspirations

All three teachers selected tools they had heard about in traditional professional development trainings. Interwrite™ Board, Mobi™ Board, and Edmodo™ were all tools that were highlighted in trainings created and delivered by the campus Instructional Specialist through the Technology Tuesday trainings. Only one of the teachers, Mrs. Cummings, was already using the technology she selected to study, although Mrs. Clayton had already sought out additional training, away from the campus, on Edmodo™ and knew it was a tool she thought would be beneficial in her classroom. Mrs. Evans, on the other hand, had only heard about the Interwrite™ Board in training, and had never actually had one in her room to use.

The selection of tools seemed to mirror the effort each teacher put into learning their chosen technology. This connection to Rotter's (1966) research specifies teachers' intrinsic and extrinsic locus of control, a factor that indicates how much risk an individual was willing to take. For Mrs. Cummings, the fact that she already had a Mobi™ Board in her classroom, and used it frequently, albeit at a very basic level, was indicative of her extrinsic risk level and motivation within the study. Frequently she could not remember what she learned previously. In addition she rarely practiced using the tools she was

learning outside of the training sessions. Most of her training sessions focused on practicing the same tools that had already been covered in previous trainings.

For Mrs. Clayton, the selection of Edmodo™ as a tool to explore with her classes demonstrated more of an intrinsic risk taker. She had seen the tool presented a year previous, as well as in Technology Tuesday and was willing to test it out on a small scale to see if it would benefit her classes. Following the interview session where she indicated her desire to study Edmodo™ and the first training session, Mrs. Clayton had already created her an account and set up her students in classrooms within that account. Most of her training session time was spent discussing what she had learned and what she was trying with her classes. Mrs. Clayton required very little attention from the researcher, because her motivation led her to continue to utilize and evaluate the tool.

Perhaps the strongest evidence of tool selection tied to motivation was the case of Mrs. Evans. Her selection of the Interwrite™ Board was significant given that she had never had access to one prior to the study, despite there being multiple available on campus. As already mentioned, the Interwrite™ Board had been presented to the faculty in a Technology Tuesday training, yet she did not feel comfortable in getting one and using it with her students. Once she selected the tool and one was provided to her, with minimal training, she was using it with her students the very next day. Throughout the training sessions, Mrs. Evans was full of questions and immediately put into practice what she was learning. Before the end of the study, she was discussing building her own Interwrite™ Board lessons and activities even though this process could take longer than simply searching for content already created.

Each teacher selected a tool they felt could help them make connections with their students, as well as tools that were practical for student achievement. None of the teachers' reasoning for tool selection related to flashy capabilities, or tools that they thought looked fun. Mrs. Evans was adamant about technology that might assist her in science instruction, and although not specifically stated that way, the other two selected tools that would assist their efforts in helping to make mathematics more interesting and understandable to their students. For each teacher, the use of technology in the classroom was tied to content support and an increased teaching and learning experience for both teacher and student.

All three teachers had aspirations that moved more toward a student-centered understanding as the study progressed. As each utilized their tools, their questions and thoughts became increasingly more student-centered in nature. Although none of the teachers necessarily moved toward implementation with the student-centered activities, they each made progress in their desire to center on the needs of the students. This indicated to the researcher, that the continued use of a technology with support, at whatever motivation level, did help these three teachers think about a more student-centered approach.

Barriers to Teacher Aspirations

Many of the typical barriers to technology integration, referred to as "if only" barriers, such as professional development goals, school culture, and access were of no issue on this particular campus and for these three participants. With an administration that valued technology, was willing to purchase what the teachers wanted to use, and expected to see implementation, the teachers were able to only focus on the barriers that,

for the most part, they could control. Whether or not the teachers would overcome the additional barriers of attitude, interest, and time, "what if" would mainly depend upon what Rotter (1966) called the locus of control. Teachers with an intrinsic locus of control would be more likely to overcome those barriers if their interest and attitude were high. Others, with an extrinsic locus of control, might be more reluctant to take risks and would be more comfortable in waiting until someone could assist them in overcoming the barriers.

Since teachers were able to select his/her technology of study, their own personal interest was already high in the chosen tool. Typically, their attitude was high as well; however, their interest level stayed high only when other barriers were not in the way of implementation. For instance, in the case of Mrs. Evans, she was highly motivated and interested to work with the Interwrite™ Board as long as she was able to receive support from the researcher. When there was a hiatus in the trainings, her interest was no longer high enough to keep her working independently, even though when the support was provided, she routinely sought out her own solutions and searched for additional resources on her own.

When knowledge and skills were low for a technology, two of the teachers were unable to overcome that barrier, even if their interest and attitude about using it was high. In the case of Mrs. Cummings, she was already using the Mobi™ Board regularly with her classes, but only as a basic tool: as a wireless mouse. Despite the Mobi™ Board having many other uses, she was uncomfortable in exploring any additional uses for the Mobi™ Board, even though this was demonstrated during Technology Tuesday training.

For one teacher, time was the factor that kept her from exploring the use of Edmodo™ with her students. Mrs. Clayton's interest was high to use this tool, and she was highly motivated to learn new technologies, yet the time it would take to evaluate the tools, prepare it for use in the classroom, and implement it was more than Mrs. Clayton was willing to give outside of the boundaries of this study. She indicated in an interview that she had actually attended some sessions on Edmodo™ at a technology conference ten months prior to the beginning of this study. The time factor had kept her from exploring a tool that she wanted to learn to use with her students for almost a year, but the training times set aside in this study, prompted her to let her interest and attitude about Edmodo™ overcome her barrier of time.

The most critical barrier for all three teachers to be successful in this study seemed to be support. All three had already attended a Technology Tuesday training session in which their chosen technologies were presented to the staff. Despite this, none of the three independently began using these technologies, either in any different ways or used at all, following the traditional professional development training. Once the follow-up support piece of the differentiated professional development training was implemented, all three were able to make progress toward mastering their technology. For two of the teachers, Mrs. Cummings and Mrs. Evans, the support was so critical to their progress that when the support waned, so did their implementation. One year following the study, all three teachers reported that they were receiving no support in their technologies, or technologies in general. Two of the three, Mrs. Clayton and Mrs. Evans, were no longer using the technology that they studied.

Technology Usage

All three teachers progressed in their technology usage. Each of the three began the study with ideas of how to integrate their chosen technologies. As the study progressed, their ideas became more detailed and more closely aligned with a student-centered approach to instruction. This idea indicated that when a technology was actually implemented it caused more ideas for usage of that technology. Occasionally, however, these ideas were not necessarily always translated into practice, perhaps because of barriers that the teacher faced in implementation. In the case of Mrs. Cummings, she was able to articulate more uses for the Mobi™ Board, but she struggled to implement what she was learning from her differentiated training. Despite her extrinsic locus of control (Rotter, 1966) that may have kept her from taking many risks without the support of the researcher, she was still able to identify further uses. This may indicate that while the barriers keep teachers with an extrinsic locus of control (Rotter, 1966) from an ideal implementation, they are able to expand their aspirations as they receive individualized support and begin to work on overcoming their barriers.

Progress Toward Student-Centered Understanding

All three teachers made significant progress toward a more student-centered understanding of technology. Even though the purpose of using the Kopcha (2010) model was to help focus the use of technology in more student-centered ways, the researcher never specifically addressed student-centered instruction with the teachers. Their movement toward a student-centered technology approach happened naturally as each explored more about her chosen technology. This indicated that the implementation of a specific technology increased the teachers' awareness of not only ways to use the

technology, as discussed above, but also purposes for that use. For example, Mrs. Clayton saw the benefits of using Edmodo™ early on in the study. These benefits included giving her students access to mathematical content twenty-four hours a day. However, as she used Edmodo™, she began to see that the tool could be used to assist her students in creating projects and more authentic assessments. This shift that moved from *ways* to use the technology to *reasons* to use the technology indicated movement toward a student-centered approach.

Professional Development Needs

All three teachers preferred a differentiated professional development model as their overall training method. Mrs. Evans specifically discussed how she frequently felt isolated and lost during traditional trainings because she was not sure exactly how the information that was presented could apply in her classroom. Mrs. Clayton was very adamant that traditional professional development trainings were a waste of her time because they tended to cover material that she already knew or was too simplistic for her abilities. All three teachers preferred the trainings conducted within this study because it was personalized and met their needs. One year after the study concluded, all three identified their preferred method of professional development as a differentiated model. This indicated that personalized instruction was a critical element for all three to make progress in technology implementation as well moving toward a more student-centered instructional approach.

In addition to the differentiated model, the teachers seemed to value the collaboration with other educators and the tool introduction aspect of a traditional professional development model. Mrs. Clayton felt that the traditional model was a good

way to quickly introduce a technology as long as there was follow-up through a differentiated model that included support during implementation. Mrs. Cummings loved the collaboration that could occur in the traditional professional development, but only for ideas that could extend her use. She still desired to have the individualized trainings that assisted her in overcoming her barriers.

Based on these points, the teachers felt that there were redeeming qualities to a traditional professional development. Based on their comments, they would prefer that the majority of their training be conducted using a differentiated approach, with traditional approaches being used to support the differentiated model. For instance, a trainer might use a traditional approach to introduce a new technology in a short meeting and then have teachers break up into smaller groups based on knowledge and skills or ability (those that have never seen it before, those that have played with it a little, and those that have used it with students) in order to work on the uses of the technology. Perhaps another traditional meeting would then be held so that teachers could discuss ideas in a large group once they have all had a chance to work with the technology for a while. The differentiated training would continue as the teachers implement the technology at their own pace and as they move toward more student-centered applications. This integrated model of the two approaches would work in tandem to satisfy each participant's needs related to the student-centered use of technology tools.

Follow-up Support Needs

The most important piece of the differentiated model was the follow-up support provided by the researcher. All three teachers were either unwilling or unable to tackle their barriers to their chosen technologies prior to the study. Whether the barrier was

time, knowledge and skills or access, all three had difficulties exploring how to integrate the technology into their classroom. For Mrs. Cummings, knowledge and skills kept her using the Mobi™ Board in the only manner she knew: as a mobile mouse for her laptop. With the support of the researcher, she was able to begin using the Mobi™ Board in new ways, albeit very slowly. As previously discussed, Mrs. Cummings had trouble with an extrinsic locus of control (Rotter, 1966) which kept her from taking risks for fear of breaking something she would be unable to resolve. Nevertheless, she did make progress within the study, but progress was only made during the differentiated trainings session with the researcher.

For Mrs. Clayton, time was a barrier that hindered her evaluation of Edmodo™ as a tool for her classroom. The researcher's support for Mrs. Clayton was only to listen to her and provide occasional ideas, but it was through these differentiated trainings that kept Mrs. Clayton moving with her implementation. As previously discussed, it appeared she needed the accountability of the researcher as support. This is due to the fact that she had an intrinsic locus of control (Rotter, 1966), which allowed her to take risks with Edmodo™.

For Mrs. Evans, access had kept her from learning about the Interwrite™ Board. Once this issue was rectified, she immediately began making progress from one training session to the next. For her, support was so crucial that when the training sessions were halted because of other commitments, her progress halted as well. Mrs. Evans's locus of control (Rotter, 1966), was extrinsic when she relied only upon herself to learn or use a technology, but became intrinsic with support from the researcher. In other words, the

reward of using technology as a classroom tool was not great enough for Mrs. Evans to master it alone, but with support, the reward became more desirable.

Most indicative of the crucial nature of support for these three teachers was their level of technology integration one year following the conclusion of the study. Of the three, only Mrs. Cummings was using their chosen technology with their students. Based on her answers, it was not clear to what extent she was using the Mobi™ Board, but because of her difficulties with learning the tools on her own, it is highly probable that she had reverted to the basic way she was using it prior to the study. The other two teachers indicated that they were not using their technologies specifically because of lack of support when implementing them in class. This gives evidence to the critical nature that support played for each of these teachers in making progress toward learning new technologies and implementing them in more student-centered ways.

Conclusion

The teachers that participated in this study overwhelmingly agreed that they preferred the differentiated model of professional development as it relates to technology integration. Using that model, the researcher was able to see growth in not only the use of technology in the classroom of these three, but also in their understanding of the concept of student-centered technology. Interestingly, each also preferred some portion of a traditional model for collaboration or for introductions of new technologies. However, in all cases, the three wanted a differentiated model to be integrated with certain characteristics of a traditional model. This collaboration of models requires professional developers to plan trainings to be much more individualized for each teacher participant.

CHAPTER FIVE

Conclusions

Professional development designers and technologists have searched for effective ways to encourage the student-centered integration of technology into classroom instruction. This study examined a possible approach to providing technology training to a teaching staff in an effort to increase the use of student-centered technology. By studying the three participants in this study, the researcher has been able to identify findings and implications that may inform professional development trainers and school districts in ways to assist teachers in technology integration, specifically for student-centered technologies.

Connection to the Research Questions

How does a differentiated professional development model impact teachers' implementation of "student-centered technology" integration? All three teachers made gains in understanding of the meaning of student-centered technology integration. When asked for ways that the participants could use technology in their classrooms the participants initially gave answers such as record television shows to show in class, collect email addresses, and provide internet access. These examples are all teacher-centered technology uses, because they benefit the teacher's job or delivery of content to the students. During the final interview, when asked the same question, the participants indicated that they would use technology to implement project-based learning activities in class, provide technology center activities, and use them for authentic assessment.

These responses indicate that the teachers understand the purpose of the technology as student-centered. While none of these three answers were observed in action in the classrooms of any of the participants, the shift in teacher belief is a step in the right direction toward student-centered technology integration.

While their answers were not observed in the classroom, all three teachers were utilizing their chosen technology in more student-centered ways, although one had activities with her chosen technology that was more conducive to student-centered technology than the other two. Mrs. Evans begin using the Interwrite™ Board with her students and found activities to use that would allow students opportunities to control an activity, game, or lesson that she had built or found on the board. Prior to this study, she had never even had an Interwrite™ Board in her classroom and admits to never having access to one to know what it could do. Mrs. Cummings used her Mobi™ Board with students, but she directed them when and how she wanted them to use it. For example, she would put up a math problem and have a single student use the Mobi™ Board to work out the problem. More often than not, she would use the Mobi™ Board as a wireless mouse to control her computer as she monitored the room. Mrs. Clayton was using Edmodo™ with students, but it was, again, teacher-directed uses. Edmodo™ has capabilities for online discussion within the program, but Mrs. Clayton only used it for her students to respond to her questions and didn't allow students to freely use the social media portion of Edmodo™ for their own learning.

After this study, the researcher determined that the use of a differentiated professional development did make an impact on the participants' beliefs about student-centered technology but did not see enough implementation of student-centered strategies

to be able to indicate that it also impacted their implementation of student-centered technology. Based on the evidence presented, the researcher concludes that this differentiated professional development assisted the teachers in making gains in understanding of the student-centered uses of technology. Perhaps an extended study time frame would provide more evidence of the impact for implementation of the student-centered technology uses.

How does a differentiated professional development model impact the ability of teachers to overcome natural barriers to technology integration? Utilizing the differentiated professional development model had great impact on teachers' abilities to overcome the barriers they faced when implementing technology. While overcoming one barrier does not pave the way toward seamless technology integration, the PD model did assist teachers in overcoming their initial barriers and continued assisting them as they came across new ones. In the beginning, Mrs. Cummings identified barriers to technology included her inability to troubleshoot any issues, not knowing how to teach with it in her classroom, and issues related to equity of availability of internet and technology. During the targeted training times with Mrs. Cummings, the researcher focused on helping her understand the purpose of the Mobi™ Board, how to use all of its features, and how to troubleshoot any issues that might arise. Since the Mobi™ Board was a tool that was not intended, nor needed, to be a device in every student's hands, nor was it a tool that would be taken home needing internet access, her training did not address the issue of equity. By the end of the study, Mrs. Cummings's barriers had changed to patience to try new things, lack of student independence when she was using the technology in class, and incorporating technology was making her lesson planning

more difficult to write. These final barriers appear, to the researcher, to be more aligned with a move toward technology integration since they are barriers that have arisen due to her actual use of technology in her classroom whereas the initial barriers were all based on fear of using the technology.

For Mrs. Clayton, initial barriers related to ideas she had about the use of Edmodo™ with her students. Her barriers included having ideas of how to use Edmodo™ in her lessons, how to manage her students within the program, and how to use her class time when using Edmodo™ as part of her instructional tools. Because she utilized Edmodo™ during the course of the study, she was able to work through all three of her barriers. By the end of the study, she was concerned with troubleshooting issues that were arising, having available equipment for those students who did not have access at home to connect on Edmodo™ for assignments, and teaching each technology that she might use with Edmodo™ (word processing documents, video creators, electronic white board apps, and other resources that students might need to upload to Edmodo™). In the beginning, Mrs. Clayton answered, "agree" when asked whether she felt that technology issues could interfere with her quality of instruction. When asked the same in the final interview, she answered "no opinion."

When Mrs. Evans began the study, her barriers included needing confidence to use the technology effectively, knowing how to infuse it into her curriculum, and how to manage any disciplinary issues that she anticipated when using the technology. During training sessions with Mrs. Evans, the researcher assisted her as she thought about effective ways to integrate the Interwrite™ Board into her curriculum. After implementing the Interwrite™ Board, Mrs. Evans reported more engagement and few

discipline issues. By the end of the study, her barriers had changed to finding time to build or find new activities, dealing with equipment that may be broken, missing, or unavailable, making herself use technology enough to feel proficient, and feeling the pressure from her colleagues when she uses technology to engage her students, who then begin to expect or demand it from other their other teachers.

Despite the ability of the differentiated model to assist teachers in overcoming their initial barriers to technology, it is important to note that two of the three participants mention access to working equipment as a barrier they face in their final interviews. This indicates that despite the ability of the model to help teachers overcome their barriers, it is useless if the school cannot provide sufficient equipment or infrastructure to support their technology use in the classroom. Without school support, the overcoming of barriers may be useless.

How does a professional development model with a structured mentoring plan impact teacher's growth in regards to uses of student-centered technology integration? All three teachers were trained in various technologies throughout the year using a traditional professional development model without any movement toward student-centered technology use. Two of the three participants' chosen technologies had been presented to the staff in "Technology Tuesday" faculty trainings without an increase in the use of the two technologies, Mobi™ Boards and Interwrite™ Boards. Additionally, after attending a statewide technology conference, Mrs. Clayton presented Edmodo™ to the faculty as a tool she found most interesting. Despite these tools having been presented to the faculty earlier in the school year through traditional professional development models, none of the teachers were using them.

Once the study began, the teachers chose their technologies to study, and the differentiated professional development was put into place, all three teachers began moving toward understanding of student-centered technology use. Based on the information collected, these participants were unable to move toward this understanding on their own, but once the mentoring piece of the differentiated model was employed, they were able to make the move. As discussed with relation to research question number one above, the teachers were all able to move from focusing on how technology assists the teacher to ways that the students could use the technology to build their own understanding.

Themes

Theme #1: All teachers' initial barriers to technology integration are not overcome by traditional professional development opportunities, thereby causing integration to be non-existent or rarely successful.

All three teachers, despite their TSAT levels, have initial barriers that relate to "what if" barriers. These barriers include those that typically relate to issues that might happen, such as "what if the network goes down," or "what if the students know more about the technology than I do," or even, "what if the technology does not work the way I want it to, how do I fix it?" This is interesting given that Donna Clayton and Faye Cummings were already using some sort of technology (other than the typical laptop, projector and document camera). This begs to question why these two would still be considering "what if" barriers. The study indicates that the barriers might be based on individual technologies and not technology in general. Considering that each technology would have its own set of rules and issues, it would be plausible to think that teachers

approach each new technology with a new set of barriers to overcome. For instance, perhaps Donna Clayton and Faye Cummings have both become somewhat proficient with the TI N-Spire calculators and therefore do not worry about "what if" barriers for those technologies that they have mastered. However, if a Lego® Mindstorm® EV3® robotics kit were introduced to these two, they would again revert to "what if" barriers when thinking about using it in their classrooms.

The question remains then, as to when do teachers actually overcome these "what if" barriers for each technology? In this study, each with their particular chosen tool, each teacher overcame the "what if" barriers and had moved on to the "if only" barriers. These barriers occur when teachers' inability to utilize technology comes from things that others need to do in order to make it easier to integrate. For example, "if only administration would purchase this technology for my entire class," "if only the network were more reliable," or "if only students would be more interested in using the technology." This may indicate that teachers are able to overcome initial barriers related to technology integration through the differentiated professional development model, especially considering that all three teachers have had traditional professional development related to their chosen technologies, some of which were delivered by the researcher previous to this study.

Perhaps individual attention was key in moving teachers through the stages of Kopcha's (2010) model. Research has a lot to say about what can keep a teacher from utilizing technology in the classroom. One of the most discussed is attitude (Hixon & Buckenmeyer, 2009; Hew & Brush, 2007). Because attitude affects motivation (Stiggins, 2008), teachers are unlikely to integrate a technology when they do not feel

good about their ability to use that technology effectively, the purpose behind why they should use it, or whether it is a better educational payoff than their standard way of teaching. Individual attention given to each teacher during professional development trainings during this study could account for the change in attitude by teachers and their willingness to overcome initial barriers.

According to the results on the TSAT that were taken by all staff that consented to participate in the study, and from whom the three participants were selected, only 23% were able to score in the Developing or Advanced stage. This finding shows that fewer than one-fourth of the staff was unable to move past their own barriers related to technology integration despite the efforts of the administrative team (of which the researcher was a part) or the district to bring quality professional development in a traditional manner. Additionally, the traditional professional development opportunities did not affect the attitude of the teachers in a positive enough manner to enable them to overcome their own barriers of attitude and motivation.

Another barrier, indicated by all three participants, included the ability to troubleshoot the technology during a lesson. For each, this was important because it would take time away from their teaching, especially if they had build a lesson to include the technology and then it did not work properly. For teachers, the inability to troubleshoot was an important "what if" barrier because oftentimes it takes more than just "plugging it in and using it," it takes time (Hixon & Buckenmeyer, 2009; Hew & Brush, 2007). Teachers need time to learn about a technology, time to figure out if and how the technology would be beneficial to their content objectives, time to create lesson plans that incorporate the technology effectively, time to troubleshoot (which oftentimes needs to

be done in the middle of a lesson which takes teaching time away from teachers who already feel that they do not have enough class time), and time to figure out how best to evaluate the effectiveness of using the technology.

Teacher initial interviews all three dealt with both internal ("what if") and external ("if only") barriers. Hixon and Buckenmeyer (2009) identify these two types of barriers as first order (those the teacher could not control) and second order (those the teacher could control). Of the three participants, Donna Clayton was the only teacher able to overcome some of the "what if" barriers related to some technologies from traditional professional development opportunities. Perhaps her younger age and recent graduation from a School of Education, gives her more of an advantage with the technology than the two older teacher participants who have been teaching for a number of years. Whatever the reason, Donna still had initial "what if" barriers, time for example, to overcome when looking at Edmodo™ (her chosen technology) since she had heard about it at a conference almost a year previous and had yet to explore it to determine its usefulness in her classroom.

Initially, the three teachers discussed barriers related to these "what if" situations. These barriers seem to be initiated from the ideas and information presented during traditional professional development opportunities. Perhaps this is because these traditional trainings do not have enough time or are not designed in such a way as to answer those questions that teachers have about implementation. Additionally, traditional professional development opportunities do not typically provide follow-up trainings with teachers to assist in the implementation process. Because of this, these "what if" barriers linger and keep teachers from integrating the technology.

During the final interviews, following the differentiated professional development process, all three teachers discussed more "if only" barriers, mostly related to better working equipment, more available technology, and increased positive student behavior with the technology. This would indicate that these three teachers were able to move beyond the initial "what if " barriers and were now focused on issues outside their control (they do have some control but these barriers tend to be related to details that others must work out in order for the integration to be smooth).

Overcoming the initial barriers related to internal control allowed teachers to have the ability, confidence, and willingness to tackle or find ways to work around the issues related to external control. For example, teachers learning how to troubleshoot technology were able to now find ways to work around not having enough technology for every student. Perhaps they rotate technology through groups of students, or allow students to work in partners to share the technology. Unfortunately this relationship does not go in the reverse order. For example, providing enough technology for every student does not necessarily encourage teachers to learn how to troubleshoot the technology. Niederhauser and Perkman (2008) state, "external factors are necessary – but not sufficient – conditions to prompt technology integration" (p. 109). It is important for school administrators to remove the external barriers for teachers, but the removal may or may not be enough to instigate a school-wide technology reform.

Once the first set of barriers was overcome, new barriers arose that needed attention. In a traditional professional development setting, any barriers addressed might help a teacher overcome them, but then additional barriers would stop furthering the integration. By using the differentiated approach, the researcher was able to assist each

teacher in overcoming the barriers as they arose. For example, Mrs. Evans' first barrier was access to the Interwrite™ Board (her chosen technology). Once the researcher was able to help her secure a board and set it up, her next barrier became knowing the functions of the board. After training in that area, she faced the barrier of finding suitable resources for her own content. Once she overcame that, she wanted to create her own lessons but was unsure how to begin. As this shows, the move toward technology integration is plagued with more of a web of barriers than a single road. Barriers, in the web, lead to any number of other barriers, each route differing for each teacher. A traditional professional development model cannot address each barrier for each teacher and for each technology. Thus, traditional methods of professional development will not necessarily lead to widespread technology integration.

Follow-up interviews, conducted one year following the end of the study provided evidence that two of the three teachers were no longer making progress with technology integration due to cited reasons of faulty equipment and lack of support from administration. Since two of the three teachers mentioned the lack of working equipment or available equipment as a barrier in their final interview, it is no surprise that this would continue to keep them from integrating technology later. One year later, the entire school administration team had changed and the new team was not supportive of the technology initiatives put into place during the previous year when this study was conducted. Of the three teachers, two were still employed on the campus, with the third in a new district. All three, however, were no longer using the technologies that they had chosen to study, mostly due to their original barriers of access, school culture, and lack of support becoming issues for them when all three worked under new administrators the next year.

All three reported that their administration did not require technology use, provide professional development on any of the available technologies, and there were no longer people available to offer support to the teachers when implementing technology.

Theme #2: Teachers' aspirations for technology use are related to their own attitudes and barriers regarding technology integration.

Given that Palak & Walls (2009) indicate that a teacher's attitude toward technology is the strongest predictor of technology integration, it is not surprising to find that the teachers' beliefs and aspirations for technology and its benefit in instruction is dependent upon the teachers' overall attitude towards the technology itself. Lumpe & Chambers (2001) categorize two types of teacher beliefs about technology integration. The first relates to whether or not a teacher has the capacity for the technology. This, according to the authors, relates to their self-efficacy. The second teacher belief deals with whether or not external factors, such as support, are likely to be available to teachers when they need them. Lumpe & Chambers (2001) therefore state that the teacher beliefs are integral in teachers' ability and decision to integrate the technology into their classroom, and therefore their desires for future uses and purposes of the technology.

All three participating teachers were asked, in the final interview, to describe the basics that they felt were essential for a teacher to know when integrating technology into their classrooms. Despite having troubleshooting the technology as a major concern when discussing their barriers to technology, none of the three teachers included it as a basic skill. This may indicate that teachers view an ideal situation in which technology troubleshooting issues do not exist because teachers are either able to reach a point where they no longer need to troubleshoot, or they reach a point where they can troubleshoot

any technology that they use. Either way, this belief will only cause further barriers to technology integration as teachers are never able to reach the point of technology knowledge saturation, in which they know all there is to know about every technology that they come across.

One of the three teachers who mentioned no basic skills that she felt were essential for her to know, but instead answered the question with a list of barriers that she still has in relation to technology integration. This may indicate that for some teachers, barriers seem so insurmountable that they cannot imagine what skills would be necessary should they ever be able to overcome their own barriers to technology integration. For teachers like this, internal, "what-if" barriers can seem so huge that seeing past them is impossible. Therefore, for these teachers, technology integration will not be increased by traditional professional development opportunities that do not provide follow-up support.

In addition to basic skills, all three expressed deeper purposes and reasons for technology selection as the study progressed. In the beginning, all three desired to study technology tools that they already had access to on campus, but after being successful with those, all three selected their second technology based on more student-centered purposes. This would indicate that when teachers find success with technology integration, it might assist them in identifying additional ways that integration could occur in their classroom. So for a teacher, like Mrs. Evans, the accomplishment of mastering the Interwrite™ Board helped her feel better equipped to take on an application of technology she had yet to explore, such as using the computers in her classroom for more individualized instructional stations.

Theme #3: Increased technology use leads to additional ideas of integration and to a deeper understanding of student-centered technology uses.

Ideas about usages of technology were scarce in the initial interviews, often very vague. In the final interview, however, ideas were much more specific, leading to the conclusion that actual use of technology in instruction leads a teacher to more ideas of integration. In this study, all three teachers had ideas in the final interview that were all either aligned with or a step toward student-centered technology more so than their initial interview answers. For example, in the initial interviews, the three teachers' ideas about technology use included recording television shows to use in class, communicating with others via email, and having internet access in the classroom. During the final interview, these same teachers stated that using project-based learning techniques during class, initiating technology centers, and using technology for authentic assessments were all ways to use technology in the classroom.

All three participating teachers grew in their understanding of student-centered technology as they became more comfortable with the technology. This would indicate that as teachers overcome various barriers, they could then begin to see more purposeful uses of the technology and how it can benefit their students' achievement. Once teachers no longer focus on troubleshooting, their focus can shift to how the technology impacts the students, thereby increasing student-centered uses of the technology.

Interestingly, all three teachers exhibited increasing amounts of student-centered understandings, yet none of them were ready to put those beliefs into practice in their classroom. Perhaps integrating the technology in student-centered ways becomes a new barrier that teachers must overcome. Implementing technology in a more student-

centered way may require teachers a new set of abilities that they may feel adequate with yet. Take as an example, a teacher allowing his or her students the opportunity to choose a technology that will best assist their own learning style. In this scenario, a teacher might feel the need to be familiar with any of the technologies that the students might select. This barrier alone may keep the teacher from using this application of student-centered technology, even if they feel strongly that it would be beneficial to the students.

Theme #4: All three teachers' preferred the differentiated professional development model but saw some key elements to traditional professional development worth keeping.

During the final interview, teachers were asked to compare and contrast a traditional professional development and a differentiated professional development. When speaking of traditional methods, teachers used wording such as, "throwing everyone in," "holds teachers back," and "here's what you could do if you ever got to hold [the technology]." On the other hand, when asked about differentiated professional development, they stated more positive words, such as, "specific to my needs," "got what I wanted," and "helped me master the technology." This indicates that all three teachers, despite their level of technology proficiency, ability and attitude about technology, or barriers, all found that the differentiated model was the most effective form of professional development for each of them. Faye Cummings and Ann Evans both stated that they learned new things and were able to implement new learning into their classrooms, and both attributed that learning to the use of the differentiated model. Donna Clayton did not gain new knowledge or improve during the course of the trainings, yet she noted that a traditional model holds her back by forcing her to sit through trainings on technology with which she is already comfortable.

The teachers favored the differentiated model but when asked what elements they would include if they could create their own professional development for the next year, all three included elements of a traditional model mixed into the differentiated approach.. Donna Clayton mentioned that in her perfect professional development, technology could be introduced "broad based in a group setting" and then followed up with differentiated elements. These findings indicate that a hybrid approach of the two types of professional development is the best way to meet the needs of teachers. The key for these three teachers seems to be the follow-up training with a coach or mentor and a community of practice that are available during the implementation process.

Barriers that have been overcome with a differentiated professional development model can become problems again when a new administration takes over and does not focus on technology. Two of the three teachers stayed on the same campus the year following this study and both report less technology use in their classrooms, citing reasons as being "lack of assistance" and "faulty equipment." Both reported minimal to no professional development training for technology during the year. One stated that this lack of focus and support had "squashed" her technology use. This would indicate that administrative support and quality resources in implementing technology are crucial to its success.

Implications

From the themes that emerged within this study, the researcher was able to identify three major implications for technology professional development practice in education. These implications have come about from what was learned from the three participants and may or may not be generalizable to all teachers. However, these results

do give a clear indication of implications that may help to improve teachers' abilities to integrate more student-centered technology into their classrooms. These implications may also assist professional developers in defining training opportunities that will assist teachers in overcoming their own barriers to technology integration.

First, teachers need to be supported in professional development in a more personalized way in order to increase their own learning and ability to implement student-centered technology into their lessons more successfully. Researchers have indicated that many technology professional development opportunities typically include goals driven by the hired trainers and provide little, if any, follow-up training to assist teachers when implementing the technology into their lessons (Cuban, Kirkpatrick, & Peck, 2001; Jenson & Lewis, 2001; Mouza, 2002). These corporate type professional development opportunities provide teachers very little time to digest the information and learn how to apply it to their classroom. In addition, when teachers typically struggle with the technology (during lesson development or delivery), the trainers are no longer available to assist and answer questions.

Suggestions for effective professional development include: 1) training centered around teacher interests and using hands-on approaches, 2) differentiated instruction in regards to groupings of participants, 3) hold teachers accountable to implement ideas presented in professional development trainings, and 4) define clear goals for PD and use those goals to design the instruction and assessment of the training (Brinkerhoff, 2006). These offerings by Brinkerhoff, as well as findings from this study, identify a differentiated approach to professional development in order to assist teachers in overcoming barriers they have to technology integration. Additionally, keeping these

suggestions in mind can assist professional development trainers in providing quality opportunities that also support teachers in ways that actually increase technology integration in the classroom.

Second, technology trainings should move to a more differentiated method while still retaining some of the key features of a traditional approach to professional development. Key components of a traditional professional development were mentioned by the teachers of this study as being beneficial, specifically the ability to gather ideas from a large group of people that many teachers get during a larger, traditional training. One teacher stated that she felt like a traditional model of professional development was useful when first introducing a new technology. Using her suggested method, the technology could be introduced to the staff, along with its basic functions and possible uses and then followed up with a more differentiated training for teachers based on their ability, interest, or readiness for the technology. This particular combination training would assist teachers in several ways: 1) introduce the new technology in a large group format that would allow for conversation and collaboration about the usefulness and possible implementation of the new technology; 2) hold teachers accountable for finding a way to use the technology; 3) provide every teacher with a support system that would help to prevent failure when using the technology because the individual attention could assist the teacher in overcoming their own individual barriers; 4) encourage sustainability of the technology by ensuring proper use and training for all teachers; and 5) build a community of technology users on campus that encourages and assists each other in implementation of various technologies for student-centered technology.

Because both traditional and differentiated concepts of professional development seemed important to the teachers in this study, it would seem beneficial to combine those components into one training method. This type of training is in line with what Flannagan & Kelly (2009) had in mind when they state that the goal of any professional learning should be "to move all teachers toward expertise in teaching" (p. 29). Because all teachers, like students, do not move at the same pace, especially when related to technology integration, it is important to take into account their individual needs. Flannagan & Kelly (2009) continue by stating, "professional development must be designed to engage, challenge, and meet each teacher where he or she is, then move the teacher forward" (p. 30). If the development of the teacher as a professional is the goal, more efforts need to be made toward making the training sessions more differentiated with opportunities to share ideas in a large group. With individualized professional development, teachers will be assisted in overcoming barriers that keep them from trying the technology in the first place. Once they are able to overcome those barriers, they will then be able to move toward student-centered technology uses. The more assistance they are given through the process, the closer to student-centered implementation they will be able to achieve. It is crucial that teachers be supported, through differentiated professional development, throughout the entire process of technology integration so that they will be able to achieve the application of student-centered technology uses with their students.

Third, administrators need to support teachers with their uses of technology, not only by expecting to see it used in the classroom, providing resources by way of training by knowledgeable others, providing plenty of working equipment that is pertinent to the

training that is provided to the teachers, but by also providing plenty of time during the school day to investigate and prepare technology for use in classrooms. This is perhaps the most critical first step in the integration of technology. Hixon & Buckenmeyer (2009) believe that schools purchasing technology was not enough of a reason for teachers to implement it into their lessons. It takes much more, such as a focus on technology integration by the administration, time allotted for teachers to learn about, plan, and use technology in their lessons, as well as an expectation from administration to see the technology integrated. All three teachers in this study reported that they were no longer using the technology they studied one year later, citing reasons as being no support from administrators, lack of technology, no professional development or assistance when implementing the technology. All of these reasons support the notion that administrator expectations, focus, and vision for technology are essential in their teachers' desire and ability to integrate technology into their classrooms.

Limitations

Time was a major limiting factor on this study. The differentiated model employed in this study was one that needed more time in order for these three teachers to move through the entire cycle. If the study would have been conducted over the course of an entire school year, perhaps one or more of the teachers could have moved through the entire cycle and then begun to start on an additional individualized plan. This notion indicates that differentiated professional development requires that teachers engage in the process over a longer period of time and it would be over time that major changes could take place. Through more long-term sustained professional development, the changes

would be more permanent, giving the teachers time to fully learn and implement the technology.

An additional limitation to this study was the small number of teacher participants. Because of the nature of a case study, the researcher selected only three teachers as participants. With a larger population to study, more data would be available to provide additional data to support the findings of this study.

Finally, the participants of this study were selected from one middle school in one school district. Because of this, the results are limited to the culture and beliefs of the particular school in which the study was conducted. A broader study would have allowed more varied beliefs and school cultures to be taken into account when interpreting the findings.

Future Research

Future research in this area should focus on more longitudinal research to see how the differentiated professional development model impacts teachers. Because the Kopcha (2010) model is based upon teachers' own ability and interest to move through at their own pace, there is no set time frame for a study to occur. Using the same model and conducting case studies that follow teachers through the entire model for one or two cycles, might provide more substantial evidence for the use of differentiated professional development for technology integration.

Conducting differentiated professional development is great in theory, but will not be cost or time-efficient in a school community. Providing each teacher individualized training will be too costly and time-consuming for practicality. Because of this, additional research using a differentiated model with small groups of teachers in alternate

settings, groupings, or formats would provide practical information for professional developers and schools to utilize.

Additionally, future research should look at more varied populations, such as from different schools, different parts of the country, or different levels of education (elementary, middle, high, college). For these studies, researchers should focus on schools with differing school cultures surrounding technology integration, as well as larger population sizes. These studies would help in assisting whether or not a differentiated professional development model helps teachers in all situations surrounding technology in schools.

Applications

The use of technology helps teach students soft-skills that we often fail to teach in schools because it is not a part of the traditional curriculum. These skills, such as collaboration, creative problem solving, flexibility, communication, and ability to work in a group, are crucial parts of the world outside the walls of our schools. Employers rely heavily on technology to help make the workplace run more efficiently and effectively. Ignoring technology as a tool will continue to put our students at a disadvantage globally. Schools must adopt the use of technology in an effort to help students integrate the technology they use everyday outside of school, into the problem solving training they are practicing inside of school.

Adopting technology in school is much more than simply purchasing technology and assigning it to classrooms. Teachers are often quick adopters of technology that will make their jobs faster or more efficient; however, the use of technology as more of a student-centered tool is much more difficult for teachers to incorporate. In order to be

successful with the adoption of technology used in such a way, schools must offer high-quality professional development opportunities that incorporate follow-up support provided during the time of integration. In addition to follow-up support, teachers also need administrators who support the use of technology by providing working equipment, high-quality professional development, and foster a school-wide expectation of use.

The differentiated professional development model utilized in this study was an attempt to see how important individualized training and follow-up support were to teachers during implementation. Some may assume that the model was unsuccessful because the three teachers were not making fast progress toward implementing student-centered technology, but the idea of student-centered teaching is one that is not fostered or appreciated in education today. Standards-based teaching, high-stakes testing and accountability have all warranted that teachers focus on the standards that must be taught, thereby ignoring the individual needs of students. Time is short and standards are extensive. This teaching style creates a cookie-cutter education system that forces teachers to teach facts or bits of knowledge, often ignoring connections to other content areas or real-world applications. Those students who struggle are held back or kept from classes that they might enjoy (art, music) so they can be remediated. In such a system, teachers struggle to justify what they know they should do for students and what they are forced to do for students. Under such limitations, teachers who are able to think in a more student-centered way regarding technology integration, even if that progress has not yet been put into practice, is most definitely progress. With more time and support given, the teachers' beliefs will translate into practice.

The researcher found it most disheartening to learn that all three teachers were no longer making progress one year later. Again, this could be indicative of an unsuccessful model employed in this study; however, a more realistic explanation is just how important each teacher felt administrative support as well as follow-up support was during the study. All three indicated the reason they were no longer using the technology was because their administration was not supporting its use by maintaining working equipment, or providing professional development, or expecting to see technology used in the classroom. They also mentioned there was no one on campus willing to answer their questions or assist them if and when they did want to integrate something into their lessons. For these reasons, school culture, controlled by the administration, is imperative when teachers are implementing technology.

Differentiated professional development was successful for these three educators. All three continued, even one year later, to mention it as their preferred method of professional development. Using a differentiated professional development assists the school in removing as many barriers from teachers as possible so they can begin working technology into their classrooms. Effective technology integration will take time, but it must be ongoing. The whole point of differentiated professional development with follow-up support is to be available to the teachers when and where they need assistance, for as long as they need assistance, not to be a one-and-done training.

Conclusion

The way teachers participate in professional developed has a great impact on whether they can or are willing to implement the tenets of the trainings offered. Through this study, participants have shed light on the fact that a differentiated professional

development for technology integration provides teachers with more benefits than a traditional professional development by itself. While teachers enjoyed certain factors of a traditional model, they overall appreciated the way they were able to play a more active role in their development, by selecting the technology tools to study, moving at their own pace, and focusing on their own needs related to the integration of that technology.

Since the purpose of education, and thus the continued learning of teachers, is the success of students, it is imperative that teachers receive professional development opportunities that line up with their needs and that assist them in moving toward being a better educator. Sparks (2004) stated that "students' abilities to craft creative, innovative solutions to problems are linked to the opportunities that their teachers have to approach their work in the same way" (p. 305). By this, we must continue working toward giving teachers more personalized professional development to ensure that they are able to continue their own professional growth in order to impact student achievement.

APPENDICES

APPENDIX A

Informed Consent

B A Y L O R

January 4, 2012

Informed Consent to Participate in
Case Studies of Teachers Participating in Differentiated Professional Development for the Purpose of Student-Centered Technology Integration

An educational research study will be conducted in your school and this form includes information related to participation. The study was designed to determine how a differentiated professional development model might impact teachers' ability to integrate student-centered technology into their classroom. Each consenting teacher will complete a Technology Self-Assessment Tool (TSAT) from the Massachusetts Department of Elementary and Secondary Education. From the results, three teachers will be selected to participate in a differentiated professional development model for the spring school semester.
Data will be collected by the researcher in the form of:

1. Massachusetts Technology Self-Assessment Tool (TSAT) and demographic information – approximately 20 minutes.

2. Classroom Observations – two to three 30 minute observations at the beginning of the study and two to three 30 minute observations from January to May.

3. Interviews – one 45 minute interview at the beginning of the study and one 45 minute interview at the end of the study.

4. Teacher lesson plans – collected from the Tennyson school house weekly from January to May.

5. Technology Brag Board entries – entries will be collected directly from the website at the end of each month, January to May.

6. Anecdotal notes – notes taken by the researcher during the course of the study.

There are no physical, psychological, and/or sociological risks involved. All data collected will be completely confidential and anonymously coded to insure privacy of all participants. All data will be disposed of five years after the completion of the study. Actual names of participants will remain confidential and will not be cited in the study. Any presentation or publication detailing the results of this study will include pseudonyms of the participants, school, and school district.

The following outlines the various components you are asked to participate in within the study:

- Completion of the Massachusetts Technology Self-Assessment Tool (TSAT) and demographic information – approximately 20 minutes at the beginning of the study.
- Differentiated Professional Development (provided during the teacher workday) – 30 minute training sessions two days a week from January to May.
- Interviews – one at the beginning of the study and one at the end, both approximately 45 minutes in length.
- Participation in developing your own personalized technology professional development – one time meeting with researcher and Instructional Specialist to determine your technology needs and to identify your own plan for training. This meeting will last approximately 45 minutes.

If you have any questions or concerns, please feel free to contact either the researcher via email (Mark_Montgomery@baylor.edu) or by phone (254-715-5642), or the faculty advisor, Dr. Sandi Cooper, via email (Sandra_Cooper@baylor.edu) or by phone (254-710-3246). Inquiries regarding the nature of the research, your rights as a subject or any other aspect of your participation can be directed to Baylor's University Committee for Protection of Human Subjects in Research. The chairman is Dr. Michael Sherr, One Bear Place # 97320, Waco, TX 76798-7320, phone number 254-710- 4483.

By participating in this study, you will make significant contributions that may lead to new findings relevant to technology professional development opportunities. Your time, expertise, and dedication are greatly appreciated. A check in one of the boxes below along with your signature constitutes your consent to either participate or your desire not to participate in this study. Non-participation involves no penalty and you may withdraw from the study at any time without penalty.

I have read and understand this form, am aware of my rights as a participant, and have agreed, based on the information provided, to participate in the study in the manner indicated below. A copy of the signed form will be provided to me and the original will be kept in the researcher's office.

□ I do not agree to participate in this study.
□ I agree to participate in this study.

_____ _____
Name (Printed) (Date)

_____ _____
Name (signature) (Date)

_____ _____
Mark Montgomery, Researcher (Date)

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APPENDIX B

Technology Self-Assessment Tool

Introduction

Welcome to the Massachusetts Technology Self-Assessment Tool
This technology instrument has been designed for:

1. **Teachers:** to determine their own levels of technology proficiency and to identify personal technology professional development needs.

2. **Schools/Districts:** to assess their professional development needs and to plan professional development activities that will help all teachers become proficient in technology.

3. **The State:** to gather and report data on technology competencies and technology professional development.

Mastery Level:
The TSAT has four mastery levels, as shown in Table B.1 below. The table shows the percentages of skills that you should complete in order to move to the next level. Although some levels do not require that you complete all of the skills, you can go back at any time to check off new skills you have learned.

Table B. 1:TSAT Mastery Levels

TSAT Level	Technology Operations & Concepts	Ethics and Safety	Teaching & Learning with Technology
Early Technology	100%	100%	100%
Developing	80%	100%	80%
Proficient	80%	100%	80%
Advanced	80%	100%	80%

Using the Technology Self-Assessment Tool
If this is the first time you are taking this assessment, you should begin at *"Early Technology"* (on page 2 of this file). The assessment presents a list of skills with check boxes. Check a skill if you are able to do all of the examples given.

Additional Information About the TSAT
A Progress Chart showing the progression of skills is included as Appendix A. Appendix B shows how the TSAT is aligned with the Massachusetts Recommended Pre-K-12 Instructional Technology Standards, the ISTE Technology Standards, and the Massachusetts STaR Chart.

Table B. 2: Early Technology Standard 1

I Know How To		**Standard 1 – Technology Operations and Concepts**
	A1.10	Demonstrate basic skills for using hardware and applications (e.g., start up and shut down computer system and peripherals, open/close a file, start an application and create a document.)
	A1.11	Navigate using scroll bars, arrow keys, special keys, and mouse functionality.
	A1.12	Identify components of a computer system (e.g., Operating system, platform, drives, memory, window). Explain their functions, and use appropriate terminology in speaking about them).
	A1.14	Save/backup and retrieve a file to/from the Desktop, hard drive, and/or floppy disk.
	A1.15	Select a printer and print a document with appropriate orientation within page setup.
	A1.20	Connect the cables and cords correctly such that a computer is functional.
	A1.30	Use basic editing and formatting features of a word processing program (e.g., centering, spacing, fonts and styles, enter and edit text, copy and paste, manipulate fonts, use writing tools and insert clip art).
	A1.80	Use correct terminology in speaking about Internet communications (e.g., browser, search engine, online)
	A1.81	Access the Internet and identify and use navigation features of browser (e.g., "go," "back," "forward").
	A1.82	Add a Web site to *Favorites* or *Bookmark* it for future reference.
	A1.83	Identify basic elements of a Web site (e.g., URL, hyperlinks, etc.) and use a URL.
	A1.90	Create and send a message using email. Retrieve and read email. Reply to sender and forward an email. Save, print and delete an email.

Table B. 3: Early Technology Standard 2

I Know How To		**Standard 2 – Ethics and Safety**
	A2.10	Apply classroom/lab rules for responsible use of technology.
	A2.11	Explain and comply with acceptable use policy in your district and describe the consequence.
	A2.20	Explain the importance of sharing technology resources equitably among all students.
	A2.30	Discuss the basic concept of assistive technologies and Universal Design for Learning (UDL), including portable word processors.
	A2.40	Explain copyrights as applied to technology use in education, the workplace and society.
	A2.41	Follow appropriate licensing and documentation for all software used.
	A2.50	Explain how media and technology can be misused to distort or exaggerate information.
	A2.60	Explain potential problems viruses create and practical methods of prevention (including exercise caution in opening e-mail attachments from unknown sources).
	A2.70	Follow the proper district/school procedures in the even of technical difficulties.
	A2.72	Explain the dangers of chat rooms and other electronic communications such as instant messaging.
	A2.80	Evaluate the proper physical setting for technology use (ergonomics).

Table B. 4: Early Technology Standard 3

I Know How To		**Standard 3 – Teaching & Learning with Technology**
	A3.10	Discuss current research on teaching and learning with technology in order to plan learning environments and experiences.
	A3.11	Use technology to gather curriculum-specific information from CD-ROMs, Web sites and /or automated card catalogue.
	A3.20	Integrate technology into the curriculum of one's subject and/or grade level with assistance of a coach, mentor or other staff member.
	A3.40	Use email to communicate with teachers and other professionals about curriculum content and procedures.
	A3.41	Use word processing to support teaching and learning (e.g., letters home to parents, course syllabi, flyers, worksheets, students' stories, etc.)
	A3.44	Identify personal technology professional development needs.

Table B. 5: Developing Technology Standard 1

I Know How To		**Standard 1 – Technology Operations and Concepts**
	B1.12	Identify and use basic features of a computer operating system (e.g., format/initialize disks, access information on size and format of a file, create and organize folders on local hard dries and desktop).
	B1.14	Manage files, to save locate and organize files on local and remote network spaces.
	B1.15	Operate peripheral equipment (e.g., scanner, printer, projector).
	B1.16	Resolve basic technical difficulties (e.g., soft reboot, paper jam, ink cartridge replacement).
	B1.20	Connect a computer to peripheral devices (e.g., printers), a network outlet, and take proper care of the system.
	B1.30	Use editing and formatting features (margin, cut and paste, spelling, and page numbers). Insert images (e.g., graphics, clip art) from other files into word-processed documents.
	B1.31	Create a report or newsletter using word-processing or desktop publishing software.
	B1.40	Describe the structure and function of spreadsheet (e.g., cells, rows, columns, and formulas) and apply formatting features, reposition columns and rows.
	B1.41	Create an original spreadsheet, entering simple formulas (various number formats, equations, percentages, exponents).
	B1.42	Interpret spreadsheet information, and produce simple charts from data.
	B1.50	Define terms (field, table, record etc.) and functions of a database and use it for simple analysis
	B1.60	Create and manipulate graphics using a drawing or painting program (e.g., adjust scale, size, shape).
	B1.70	Create a simple multimedia presentation (using PowerPoint, KidPix, etc.) and explain the terminology (slide, transition, etc.)
	B1.80	Differentiate among browser, email program and Internet service provider.
	B1.82	Organize *Bookmarks* or *Favorites* into folders for future reference.
	B1.83	Identify and use basic search strategies on the Internet.
	B1.90	Send an email attachment, open and save on to the desktop.
	B1.91	Create an address book in an e-mail program.

Table B. 6: Developing Technology Standard 2

I Know How To		**Standard 2 – Ethics and Safety**
	B2.20	Ensure equitable access to technology resources for all students in the class.
	B2.30	Use basic assistive technology resources. For example, change text size or make templates in a word processor, use text-to-speech features, change mouse controls, use on-screen calculators.
	B2.40	Cite electronic sources correctly in accordance with copyright law, explain and model this in the classroom.
	B2.41	Explain and demonstrate ethical and legal behavior in copying/downloading files, applications, and media (Internet).
	B2.42	Ensure responsible uses of technology by students: a. including intellectual property, b. copyright laws, c. effective use of resources, and d. environmental concerns.
	B2.50	Validate a Web site for authenticity (e.g., find site sponsor, author, date the site was last updated, etc.)

Table B. 7: Developing Technology Standard 3

I Know How To		**Standard 3 – Teaching & Learning with Technology**
	B3.10	Design and develop lessons and activities that integrate technology in a variety of instructional settings for all students.
	B3.11	Identify and locate technology resources including online curriculum resources (district curriculum guides) for planning.
	B3.20	Facilitate technology-enhances lessons that address content standards and student technology standards.
	B3.21	Manage student technology activities to optimize learning with available resources (e.g., in a one-computer classroom, a computer lab, or with portable/wireless technology).
	B3.23	Use appropriate technology to differentiate instruction (multimedia presentations, concept maps, etc.) for all learners.
	B3.30	Apply technology in assessing student learning of subject matter using a variety of district, school, or individual assessment tools and strategies (e.g., TestWiz, grading programs or progress spreadsheets).
	B3.41	Use application programs to organize curriculum-specific information/data into charts, tables and diagrams (spreadsheets, databases, etc.).
	B3.42	Create multimedia presentations to communicate curriculum content.
	B3.43	Integrate results of electronic research into classroom instruction, (with proper citations) as appropriate to the grade level.
	B3.44	Locate and enroll in appropriate technology professional development activities offered by the district, online or local college/university.

Table B. 8: Proficient Standard 1

I Know How To		**Standard 1 – Technology Operations and Concepts**
	C1.14	Save (also retrieve, load, and import) documents in different file formats (e.g., RTF, HTML) to facilitate file sharing.
	C1.15	Use a variety of external peripherals (e.g, digital camera, camcorder, CD-RW, scanner) and connect them to a computer.
	C1.16	Resolve commonly occurring technology problems, and use proper terminology for communicating them (e.g., frozen screen, disk error, printing problems).
	C1.17	Identify, download and use multimedia, graphic, sound and video files.
	C1.18	Install new software from a variety of sources (e.g., CD, downloads, plug-ins and applications) per district policies.
	C1.41	Use built-in calculating functions in a spreadsheet application.
	C1.42	Customize formatting of charts or graphs created in spreadsheet. Define and use built-in data functions of a spreadsheet such as sort, filter, find.
	C1.50	Perform simple operations in a database (e.g., browse, sort, search, delete, add data, define field formats, etc.).
	C1.70	Create a multimedia presentation that includes imported sound and graphic files, tables and a design template.
	C1.83	Demonstrate effective search strategies to locate and retrieve electronic information (e.g., use syntax and "Boolean logic operators – and/or terms" correctly).
	C1.84	Share links among users via email or posting.
	C1.85	Create a basic Web page.

Table B. 9: Proficient Standard 2

I Know How To		**Standard 2 – Ethics and Safety**
	C2.30	Use specific assistive technology software (e.g., programs that use pictures/symbols with words, talking word processing, or word prediction).
	C2.72	Address situations where inappropriate sites are accessed, and contact proper district personnel to block such sites.
	C2.80	Demonstrate and teach students the issues of ergonomics (e.g., repetitive stress injuries) and how to use equipment safely.

Table B. 10: Proficient Standard 3

I Know How To		**Standard 3 – Teaching and Learning with Technology**
	C3.11	Evaluate technology resources, including online resources for accuracy and suitability.
	C3.12	Plan for the management of technology resources within the context of learning activities (schedule use of computer lab, wireless laptops, SmartBoards, etc.).
	C3.20	Use technology to support learner-centered strategies that address all students.
	C3.21	Manage student learning experiences that integrate effective uses of technology to meet a variety of learning styles.
	C3.22	Use the Internet for curriculum development and instruction (e.g., Web Quests, classroom web pages).
	C3.23	Use appropriate technology tools to enhance one's own curriculum, if applicable: projectors, wireless laptops, handhelds, environmental probes, sensors, robotics, dynamic geometric software, and measuring devices.
	C3.30	Use technology resources to collect and analyze data, interpret results, and communicate findings to improve instructional practice and maximize student learning.
	C3.31	Identify and evaluate developing technologies as they relate to one's subject area, grade level and student population.
	C3.41	Manipulate data using charting tools and graphic organizers (e.g., concept mapping, and outlining software) to connect ideas and organize information.
	C3.43	Use electronic conferencing tools such as Internet bulletin boards as in VES and MyBPS.
	C3.44	Apply technology professional development activities such as multimedia presentations, Web Quests, lessons in the classroom.

Table B. 11: Advanced Standard 1

I Know How To		**Standard 1 – Technology Operations and Concepts**
	D1.16	Troubleshoot and add new hardware.
	D1.17	Identify and use methods for transferring, downloading, and converting graphic, sound, and video files. Use different graphic file formats where appropriate (e.g., PICT, TIFF, JPEG).
	D1.18	Import/export and link data between spreadsheet, databases and other applications, including presentation applications.
	D1.50	Design, create and manipulate an original database.
	D1.85	Create and post a Web page per district policy.

Table B. 12: Advanced Standard 2

I Know How To		**Standard 2 – Ethics and Safety**
	D2.30	Manage assistive technology equipment and install peripherals for diverse learners (alternative keyboards, voice recognition, and scanners with OCR software).

Table B. 13: Advanced Standard 3

I Know How To		**Standard 3 – Teaching and Learning with Technology**
	D3.20	Use technology to challenge students to use higher order thinking skills and creativity (e.g., applets and programs that require the application of logic to solve problems).
	D3.22	Develop web pages for instruction and communication.
	D3.23	Use specialized technology tools for problem solving, decision-making, and creativity (e.g., simulation software, environmental probes, computer-aided design, geographic information systems, dynamic geometric software, graphing calculators, art and music composition software).
	D3.31	Routinely and rigorously identify, evaluate, and apply emerging technologies as they relate to teaching and learning.
	D3.41	Combine information from different applications (e.g., a chart imported from a spreadsheet into a word-processes report can be linked to update automatically when the data is changed in the spreadsheet) to enhance/clarify communication of information.
	D3.42	Present information, ideas, and results of work using the most appropriate communications technologies (e.g., multimedia presentations, Web pages, digital videotapes, desktop-published documents.
	D3.43	Use electronic communications to enhance teaching and learning (e.g., listserv, electronic classrooms, and interactive video).
	D3.44	Design and deliver effective staff development in technology and its integration in curriculum.

APPENDIX C

TSAT Level Indicator (Sample Data)

Teacher Name	TSAT Level	Technology Operations & Concepts	Total	Min.	Score	Met?	Ethics and Safety	Total	Min.	Score	Met?	Teaching & Learning with Technology	Total	Min.	Score	Met?	Status
Brown, Joe	Early	100%	12	12	12	Yes	100%	11	11	10	No	100%	6	6	6	Yes	Early
	Developing	80%	18	14	17	Yes	100%	6	6	2	No	80%	10	8	8	Yes	
	Proficient	80%	12	9.6	12	Yes	100%	3	3	3	Yes	80%	11	8.8	8	No	
	Advanced	80%	5	4	2	No	100%	1	1	1	Yes	80%	8	6.4	1	No	
Duncan, Mary	Early	100%	12	12	12	Yes	100%	11	11	11	Yes	100%	6	6	6	Yes	Developing
	Developing	80%	18	14	18	Yes	100%	6	6	4	No	80%	10	8	6	No	
	Proficient	80%	12	9.6	0	No	100%	3	3	0	No	80%	11	8.8	1	No	
	Advanced	80%	5	4	2	No	100%	1	1	0	No	80%	8	6.4	0	No	

APPENDIX D

TSAT Question Issues

The following indicates the TSAT number and questions that teachers could not accomplish in regard to technology (by their own indication on the TSAT):

1. Two teachers could not identify components of a computer system (e.g., Operating system, platform, drives, memory, window), explain their functions and use appropriate terminology when speaking about them (TSAT A1.12 – *Early Technology*, Technology Operations and Concepts).

2. One teacher could not connect the cables and cords correctly in order to make a computer functional (TSAT A1.20 – *Early Technology*, Technology Operations and Concepts).

3. One teacher could not explain and comply with the district-acceptable use policy and describe the consequences (TSAT A2.11 – *Early Technology*, Ethics and Safety).

4. Nine teachers could not discuss the basic concept of assistive technology and Universal Design for Learning (UDL), including portable word processors (TSAT A2.30 – *Early Technology*, Ethics and Safety).

5. Two teachers could not explain copyrights as applied to technology use in education, the workplace and society (TSAT A2.40 – *Early Technology*, Ethics and Safety).

6. One teacher could not follow appropriate licensing and documentation for all software used (TSAT A2.41 – *Early Technology*, Ethics and Safety).

7. One teacher could not explain how media and technology can be misused to distort or exaggerate information (TSAT A2.50 – *Early Technology*, Ethics and Safety).

8. One teacher could not explain potential problems viruses create and practical methods of prevention (including exercising caution in opening e-mail attachments from unknown sources) (TSAT A2.60 – *Early Technology*, Ethics and Safety).

9. One teacher could not explain the dangers of chat rooms and other electronic communications such as instant messaging (TSAT A2.70 – *Early Technology*, Ethics and Safety).

10. Two teachers could not evaluate the proper physical setting for technology use (ergonomics) (TSAT A2.80 – *Early Technology*, Ethics and Safety).

11. Six teachers could not discuss current research on teaching and learning with technology in order to plan learning environments and experiences (TSAT A3.10 – *Early Technology*, Teaching and Learning with Technology).

12. One teacher could not use technology to gather curriculum-specific information from CD-ROMs, Web sites and/or automated card catalogue (TSAT A3.11 – *Early Technology*, Teaching and Learning with Technology).

13. Two teachers could not integrate technology into the curriculum of one's subject and/or grade level with assistance of a coach, mentor or other staff member (TSAT A3.20 – *Early Technology*, Teaching and Learning with Technology).

14. Two teachers could not identify personal technology professional development needs (TSAT A3.44 – *Early Technology*, Teaching and Learning with Technology).

APPENDIX E

TSAT Questions that Were Considered for Elimination

The following indicates the TSAT number and questions that were not indicated that teachers could accomplish in regard to technology:

- Teacher one – question related to identifying personal technology professional development needs (TSAT A3.44 – *Early Technology*, Teaching and Learning with Technology). It was determined that this is a piece of the research study and was not required as a prerequisite to be considered. This teacher was added to the pool of potential participants.

- Teacher two – question related to integrating technology into the curriculum of one's subject and/or grade level with assistance of a coach, mentor or other staff member (TSAT A3.20 – *Early Technology*, Teaching and Learning with Technology). Since this is the whole purpose for the study, this teacher was added to the pool of potential participants.

- Teacher three – question related to identifying components of a computer system (e.g., Operating system, platform, drives, memory, window), explain their functions and use appropriate terminology in speaking about them (TSAT A1.12 – *Early Technology*, Technology Operations and Concepts). It was determined that this is a basic technology skill and is a prerequisite to be considered. This teacher was removed from the potential participant pool.

- Teacher four – question related to following appropriate licensing and documentation for all software used (TSAT A2.41 – *Early Tec*hnology, Ethics and Safety). This is a major piece of proper usage of technology, so this teacher was removed from the pool of potential participants.

APPENDIX F

Interview Protocol

Participant Name: _____
Interview Date: _____ Time: _____ Location: _____

SAY: You are being recorded today for the sole purpose of being able to produce a transcript of our discussion. The transcript will be analyzed as part of the data collection in my study. Do you consent to being recorded?

SAY: Please state your name, today's date, and what you teach.

SAY: What is your role in the study I am conducting?

SAY: I am going to ask you some questions, some have been predetermined, but some may come based on what you say in response to some questions. There is no right or wrong answers, so please answer as honestly as possible. Some questions are going to refer to the terms hardware and software. Are you familiar enough with these terms to answer questions about them?

SAY: During this interview, I am strictly a researcher. What we talk about does not reflect on your job or on me as your instructional coach. The information I learn from conducting this study will help to build future trainings to better meet the needs of our teachers, so again, please feel free to answer as honestly as possible.

SAY: Are you ready to begin?

1. What technologies are you currently using in your classroom? How are you using them specifically?

2. How often do you use technology in your instruction?

3. What would you say you need in order to be better at using technology in your instruction?
    a. Lack of knowledge and skills?
    b. Time?
    c. Hardware or software?

4. What hardware, software, web resource that you currently use are the most useful for you?

5. What hardware, software, web resource would be the most useful for you if you had them?

6. Can you easily access the technology resources available in your school or district?

7. What is easy or difficult about access to the technology (hardware, software, or web resources?)

8. What specific barriers (not hardware, software, or web resources) do you face when implementing technology into your classroom?

9. What practical factors hinder your ability to involve students in hands-on technology activities?

10. When thinking about technologies, what are the essential skills you want your students to master?

11. What would you say would be the essential technological skills that any teacher must possess to be successful?

12. Could there be a more equitable and productive distribution of technologies in the school? If so, what would it look like?

13. Are you happy with the current status of technology at your school? Could it be better? How?

14. Can you name any ways that school organizational climate or structures can be made more conducive to the use of technologies?

15. How does your school administration encourage your adoption of technologies in your classroom?

16. What kind of problems would you expect if your students have easy access to a variety of technologies in your classroom?

17. When you envision your ideal classroom, how would you like for your students to be using technology?

18. What technologies do your students have access to outside of school?

19. What technologies do you utilize outside of school?

20. Do you have any ideas as to how to utilize these technologies in the classroom?

SAY: The next questions ask you to rate your agreement using the following scale:
Strongly Agree Agree No Opinion Disagree Strongly Disagree

1. Using technologies in my classroom takes too much time away from mastery of Texas Essential Knowledge and Skills (TEKS)

2. Taking time to use technologies might negatively affect my students' State of Texas Assessment of Academic Readiness (STAAR) scores.

3. If I rely on technology use, my students will not have the basic skills they need to succeed on STAAR.

4. I do not have time to learn enough about how to use technologies in my classroom.

5. Technical problems might interfere with the quality of instruction in my classroom.

Questions adapted from Cifuentes, Maxwell, and Bula, 2011)

APPENDIX G

Final Interview Protocol

Participant Name: _____
Interview Date: _____ Time: _____ Location: _____

SAY: You are being recorded today for the sole purpose of being able to produce a transcript of our discussion. The transcript will be analyzed as part of the data collection in my study. For the purpose of the recording, I will ask each person present at this meeting to please state your name, your job title, your role in my study and whether you consent to being recorded today.

Name	Job Title	Role in Study	Consent

SAY: Before we get to the interview questions, we need to create one more Individualized Professional Development Plan for you. Although we may not have completely made it through all four stages of Kopcha's model with your training on Edmodo/MobiBoards/InterwriteBoards, it is necessary for my study to complete a second plan for you. We will not be fulfilling this plan, just creating one.

Identified Technology for PD

_____

Barriers/Logistics to consider:

Ideas for Implementation of technology:

Specific Requests/Needs

SAY: Now, I am going to ask you some questions, some have been predetermined, but some may come based on what you say in response to some questions. There is no right or wrong answers, so please answer as honestly as possible. During this interview, I am strictly a researcher. What we talk about does not reflect on your job or on me as your

instructional coach. The information I learn from conducting this study will help to build future trainings to better meet the needs of our teachers, so again, please feel free to answer as honestly as possible.

SAY: We have spent the last semester working together on an differentiated professional development plan that you helped design. For the most part, this interview will ask you to reflect on this process. There may be times in the interview that I will ask you to reflect on a more traditional technology professional development, such as Technology Tuesday, but I will instruct you when that will be necessary. Are you ready to begin?

1. What technologies are you currently using in your classroom? How are you using them specifically?

2. How often do you use technology in your instruction?

3. What would you say you need in order to be better at using technology in your instruction?

4. What specific barriers (not hardware, software, or web resources) do you face when implementing technology into your classroom?

5. What practical factors hinder your ability to involve students in hands-on technology activities?

6. When thinking about technologies, what are the essential skills you want your students to master?

7. What would you say would be the essential technological skills that any teacher must possess to be successful?

8. What kind of problems would you expect if your students have easy access to a variety of technologies in your classroom?

9. When you envision your ideal classroom, how would you like for your students to be using technology?

10. What technologies do your students have access to outside of school?

11. What technologies do you utilize outside of school?

12. Do you have any ideas as to how to utilize these technologies in the classroom?

13. Before we began our differentiated professional development, how would you describe your comfort level with Edmodo/MobiBoards/InterWriteBoards?

14. How would you describe your comfort level with Edmodo/MobiBoards/InterWriteBoards after our differentiated professional development?

15. Compare/contrast differentiated professional development with a traditional professional development.

16. What elements of differentiated professional development are the most beneficial to you?

17. What elements of a traditional professional development are the most beneficial to you?

18. What elements would make a traditional professional development more effective?

19. What elements would make differentiated professional development more effective?

20. Explain how you see yourself going forward with using Edmodo/MobiBoards/InterWriteBoards now that our differentiated professional development is completed for the year.

21. Reflecting on the Community of Practice that we discussed, on a scale of 1 to 5 with 5 being very likely and 1 being very unlikely, how likely would you be to use this community if it consisted of the following?
    a. All digital (people you may never meet, but can access via discussion boards, email, or other digital means)
    b. All in-house (people who are actually on your campus)
    c. A system of blogs or websites with suggestions, activities, and discussion boards
    d. A combination of all the above

22. If you were given the opportunity to design a professional development opportunity for technology integration that would make the most impact on you and your ability to integrate technology, what would you design?

SAY: The next questions ask you to rate your agreement using the following scale:

Strongly Agree Agree No Opinion Disagree Strongly Disagree

1. Using technologies in my classroom takes too much time away from mastery of Texas Essential Knowledge and Skills (TEKS)

2. Taking time to use technologies might negatively affect my students' State of Texas Assessment of Academic Readiness (STAAR) scores.

3. If I rely on technology use, my students will not have the basic skills they need to succeed on STAAR.

4. I do not have time to learn enough about how to use technologies in my classroom.

5. Technical problems might interfere with the quality of instruction in my classroom.

Questions adapted from Cifuentes, Maxwell, and Bula, 2011)

APPENDIX H

Follow-Up Interview Protocol (One Year Later)

- What technologies are you currently using in your classroom and how are you specifically using them?
- What specific barriers/factors have assisted/hindered your ability to implement technology this school year?
- What practical factors hinder your ability to involve students in hands-on technology activities?
- When you envision your ideal classroom, how would you like your students to be using technology?
- Describe your technology professional development opportunities this school year.
- How have your technology professional development opportunities impacted your technology use?
- If you were given the opportunity to design your own professional development plan and carry it out for an entire school year, explain what it would look like and why.

APPENDIX I

Individualized Professional Development Protocol

Identified Technology for PD _____

Barriers/Logistics to consider:

Ideas for Implementation of technology:

Specific Requests/Needs:

In order to accomplish this, we will need to meet two times a week for about 30 minutes each time, if possible. This can replace your attendance at Technology Tuesdays, although you are more than welcome to continue attending those if you find them beneficial.

When would be the best time to meet with you each week?

Finally, Kopcha's Professional Development Model is designed so that as soon as we are able to complete all four stages with one technology, we can meet again and identify another technology to work toward implementing. Also, please note that Becky and I are still able to assist you with any technology needs you have that are not identified within this plan created today. You are not simply bound to this one plan only; it is simply the technology that I will be studying for the purpose of my study.

Do you have any final questions, comments, or anything that you feel might be pertinent to anything we discussed today?

Signatures:

_____ _____

Teacher Date

_____ _____

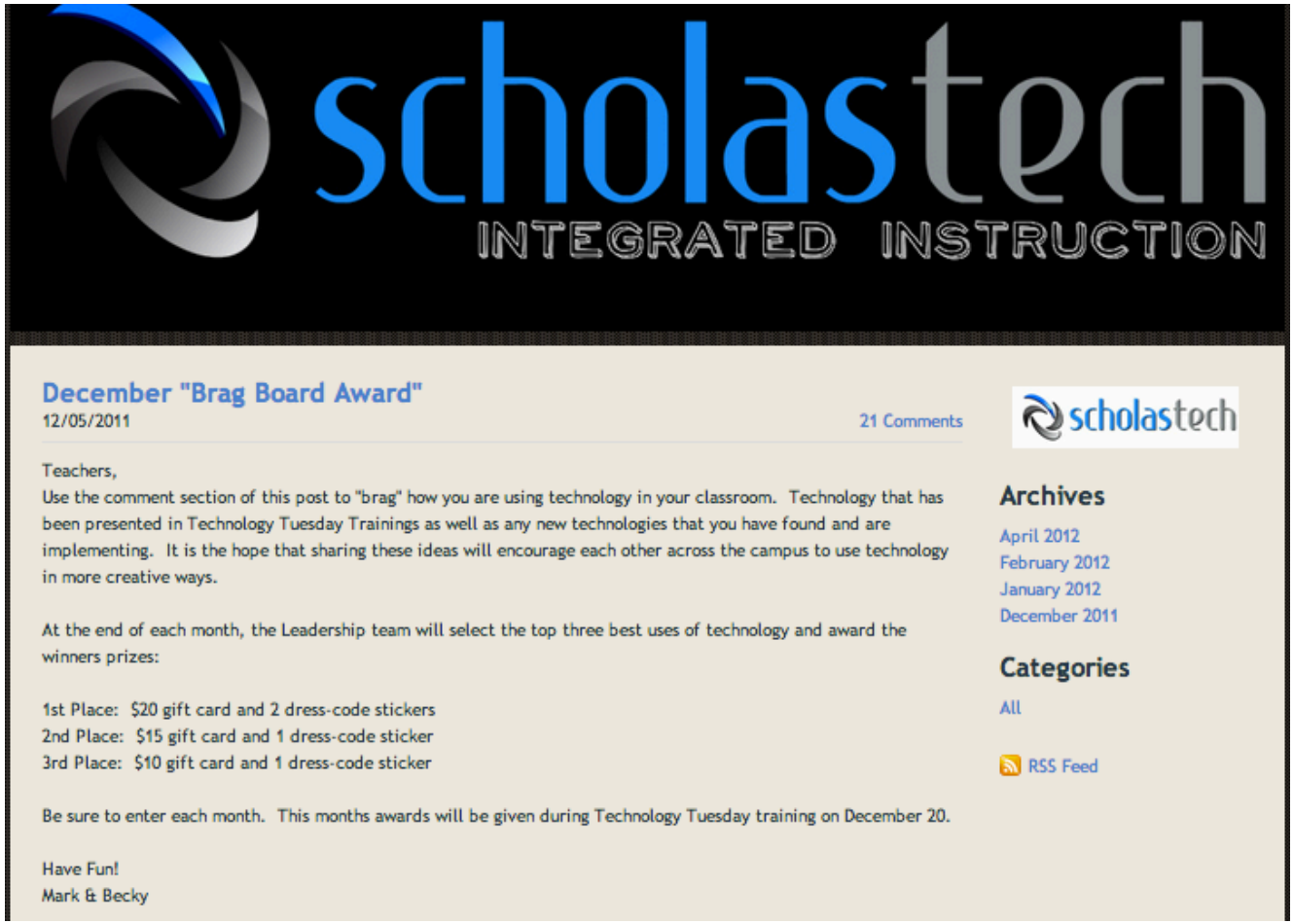
Mark Montgomery, Researcher Date

_____ _____

Becky Odajima, Instructional Specialist Date

APPENDIX J

Teacher Technology Blog



scholastech
INTEGRATED INSTRUCTION

December "Brag Board Award"

12/05/2011 21 Comments

Teachers,
Use the comment section of this post to "brag" how you are using technology in your classroom. Technology that has been presented in Technology Tuesday Trainings as well as any new technologies that you have found and are implementing. It is the hope that sharing these ideas will encourage each other across the campus to use technology in more creative ways.

At the end of each month, the Leadership team will select the top three best uses of technology and award the winners prizes:

1st Place: $20 gift card and 2 dress-code stickers
2nd Place: $15 gift card and 1 dress-code sticker
3rd Place: $10 gift card and 1 dress-code sticker

Be sure to enter each month. This months awards will be given during Technology Tuesday training on December 20.

Have Fun!
Mark & Becky

scholastech

Archives

April 2012
February 2012
January 2012
December 2011

Categories

All

RSS Feed

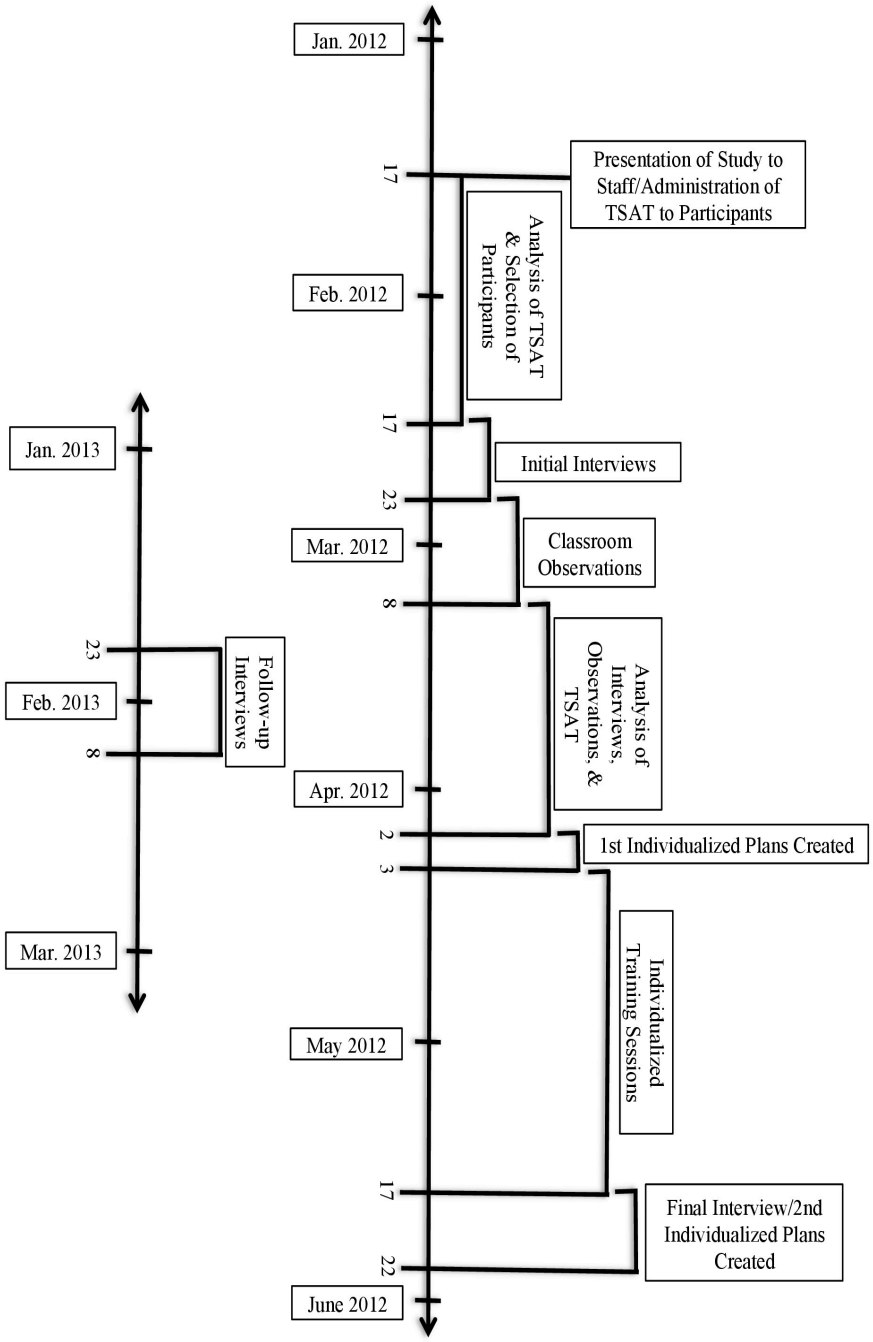
APPENDIX K

Training Plans

	Clayton	Cummings	Evans
Tool Selection	Edmodo	Mobi™ Board	Interwrite™ Board
Was Tool Taught in TPD setting?	No	Yes	Yes
Number of Training Sessions	8	8	7
Week 1 Training	Set-up and ideas for classroom use	Switching between "live version" of website and screenshot of website on which she can use the tools to write.	Deliver, set-up of Interwrite™ Board, discuss basics of how to use it and looking for resources that have already been created.
Week 2 Training	Assigning grades, building lessons, differentiating instruction by individual state objective, assigning "badges" to increase student engagement	Lost Mobi™ Board pen (students stole it), switching between "live version" of website and screenshot of website, using the curtain feature of the onboard tools	Multiple user functionality on the Interwrite™ Board, layered lessons, using onboard tools to annotate on a PowerPoint presentation, exploring onboard tools
Week 3 Training	Using Edmodo with stations, discuss logistics of using Edmodo with all of her classes, using Edmodo with projects	Using the ruler feature of the onboard tools, download gallery of pictures and activities to computer, password protecting her computer to keep students from continuing to change items on her computer.	Using a digital microscope, discussion of CSI unit that she found for the Interwrite™ Board
Week 4 Training	Ways to increase accessibility to Edmodo for students without access at home	Switching between "live version" of website and screenshot of website, discuss student-centered uses for Mobi™ Board, explore onboard tools	Discussion of ways Mrs. Evans was using the Interwrite™ Board with students, Community of Practice, resources for Interwrite™ Board
Week 5 Training	Community of Practice, resources for Edmodo	Switching between "live version" of website and screenshot of website, Community of Practice, resources for Mobi™ Board	

APPENDIX L

Study Timeline



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