ABSTRACT

WOLFE, TERRANCE JAMES. Middle School Science Teacher Experiences with Two Online Situated Technology Professional Development Programs: A Case Study. (Under the direction of Dr. Kevin Oliver.)

The aim of this qualitative case study was to examine teacher situated technology professional development utilizing two free online programs that align to the National Educational Technology Standards for Teachers (NETS-T). Six middle school (grades 6-8) science teachers from districts inside of North Carolina were selected to participate. Data was collected for this case study through audio-recorded semi-structured interviews, teacher-created artifacts, and teacher logs. Findings from this study suggest that situated technology professional development has the potential to positively impact the way teachers perform professional development. Teachers from this study believed that a combined course and self-guided approach had the greatest potential to enhance teacher practice. Additional findings from this study include a Technology Abundance Paradox (TAP) which outlines the idea that schools and classrooms have abundant technology, but insufficient training to use it. Teachers are continually being charged with finding their own professional development training, but also face barriers to that training, such as lack of time, resources, and support. A list of criteria for optimal professional development was created based on the feedback from teacher participants and can be used to enhance current and future technology professional development.

The research questions driving the study were: (1) What are teachers’s experiences with situated technology professional development programs that help teachers learn to integrate technology consistent with National Educational Technology Standards for Teachers (NETS-T)? Participants in this study found the two programs utilized in this study
to be relevant, engaging, helped to create personalized materials, and aligned to the ISTE NETS standards. (2) What characteristics of selected situated professional development programs help teachers meet their need for self-directed, in-context, time-sensitive training? Participants noted that the course approach to situated technology professional development as better than the self-paced model and cited that it was what they were use to, appreciated being told what to do in a step-by-step manner, and liked that it allowed them to plan time better because they knew what to expect. However, several aspects of the self-paced approach to situated technology professional development were noted as valuable, including: providing participants with inspirational models, ideas, and examples through video and sample lessons, introduced practical technology tools, and allowed time for self discovery. (3) What limitations of situated professional development programs should be improved to better meet teacher needs? Participants in this study noted a lack of communication between colleagues and a facilitator, no grade level or content area tracks, limited or no table of contents, and need for more audio as limitations to the two programs utilized. (4) What similarities and differences are noted between a course approach and self-guided approach to situated professional development? Participants cited structure and assessment as differences in the two programs; Intel was organized and sequential compared to Edutopia, and Intel provided quizzes and an Action plan while Edutopia did not. A similarity noted by participants that was valuable was choice. Intel participants were able to choose two out of six different modules, while Edutopia participants were able to navigate their own path through the program by choosing hyperlinks.
Middle School Science Teacher Experiences with Two Online Situated Technology Professional Development Programs: A Case Study

by
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A dissertation submitted to the Graduate Faculty of North Carolina State University in partial fulfillment of the requirements for the Degree of Doctor of Philosophy

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BIOGRAPHY

Terrance James (TJ) Wolfe was born in Marlton, NJ and moved to North Carolina in the eighth grade. He studied Elementary Education at Appalachian State University and received his first teaching position as a 6th grade science teacher. While teaching on the beautiful crystal coast, TJ saw first hand how technology has the potential to impact the lives of young people as they explore the world around them. It was the impact of one student in particular that catapulted him into exploring technology in education on a deeper level. This brought him to NC State and the Instructional Technology program. It is TJ’s hope that the work completed in this study will help students and teachers better understand the potential technology has to enhance learning, but also understand that it’s people that matter most, technology is only one tool we can use to better understand each other.
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CHAPTER ONE: INTRODUCTION

Government spending on, and access to, technology resources in education are increasing (National Center for Education Statistics, 2006). As part of the American Recovery and Reinvestment Act of 2009, more than 600 million dollars was given to states as a grant for educational technology (U.S. Department of Education, 2012). Spending on information technology (IT) in education is expected to increase to $47.7 billion by 2008 and reach over $56 billion in 2012 (Nagel, 2008). “In addition to hardware and infrastructure, the wide availability of Web 2.0 tools has made access to powerful communication and collaboration tools almost a ‘non-issue’ for any teacher who has Internet access in his/her classroom” (Ertmer et al, 2012, p. 424). The infusion of funds and development of technology have made it possible for nearly 100% of public schools to have Internet access (Greenhow, Robelia, & Hughes, 2009, Ertmer, Ottenbreit-Leftwich, Sadik, Sendurur & Sendurur, 2012). However, despite these improvements in infrastructure and access to tools, educators and the public have realized that having technology in place does not immediately result in educational achievement (King, 2002).

According to Drexler, Baralt and Dawson (2008) one of the most identified reasons new technology is not integrated into classrooms is a lack of professional development (Drexler, Baralt, & Dawson, 2008). Current models of training exist to support teacher technology growth, however not all teachers are exposed to them, have the time to devote to learning them, and/or their schools do not have the funds to purchase them. Stranack (2012) states that, “one of the first items to go during a time of financial restraint is the professional development budget line, limiting the availability of
work-funded conference participation, travel, journal subscriptions, and course fees” (p. 1). There is also a lack of professional development by teachers due to regular duties and responsibilities, meetings, leadership expectations, extra curricular activities, and more (Cuban, 2001). “Effectiveness, efficiency, and sustainability” (p. 384) are key issues that deter professional development programs (Holmes, Polhemus & Jennings, 2005).

According to Russell, Carey, Kleiman and Venable (2009) traditional professional development, “has some limitations, including being expensive and impractical to deliver” when all teachers would need to meet synchronously. Little and Housand (2011) see that teacher integration of technology in the classroom is lacking, “partially because of funding and resource issues” (p.19) in regards to professional development.

Teachers are becoming responsible for performing their own professional development (Marrero, Woodruff, Schuster & Riccio, 2010) and learning curriculum (Costa, 2009). According to Costa (2009):

“Although learning online is not the only route individuals should be seeking as to update or acquire new skills, the fact is that web environments do prove to be a rich source for continuous development, free of scheduled programmes, contrived curricula or restricted to a specific location or time zone. We can thus say that Web 2.0 Learning Environments have become quite liberating in the way they allow individuals interested in pursuing their own learning, their own way, at their own pace and with their own adopted communities and/or networks” (p. 27).
With increased responsibilities, teachers also have less time for professional development, often leaving them frustrated (Dede, Ketelhut & Whitehouse, 2009). Dede et al. (2009) also express the need for, “real-time, ongoing, work-embedded” (p. 9) professional development opportunities that, “make certain that time, effort, and scarce resources are expended on quality programs that teach with and about best practices” (p. 8).

With spending on educational technology rising, but training and support for teachers for integrating technology not increasing, there is an apparent Technology Abundance Paradox. Classrooms are being filled with computer hardware and software that teachers are not skilled to integrate in order to increase student achievement. Figure 1 below gives an illustration of the Technology Abundance Paradox.

Figure 1: Technology Abundance Paradox

Online professional development, and the use of Web 2.0 tools, has created, “a meaningful alternative to formal learning and training” (Costa, 2009, p. 28). Teachers are now in need of a self-guided, time- and resource-sensitive way to learn about integrating technology into their classrooms. Croft, Coggshall, Dolan, Powers & Killion (2010) report
that adults learn best when they are self-directed, building new knowledge upon preexisting knowledge, and aware of the relevance and personal significance of what they are learning.

**Statement of the Problem**

Situated professional development has the potential to deeply impact teachers’ attitudes and use of technology through personal training and support. (Kopcha, 2012). These professional development models are “situated in particular physical and social contexts, . . . social in nature, and . . . distributed across the individual, others, and tools” (Swan, Holmes & Vargas, 2002, p. 2). One example is Intel Teach to the Future, an online program that seeks to support teachers in the integration of technology in the classroom. More than forty hours of training are available and separated into ten modules that can be completed from one to ten weeks. Participants can choose when and where to complete their work and end the course with a capstone evaluation (Harris, 2005). Module choices range from Thinking Critically With Data to Assessments in 21st Century Classrooms to Collaboration in the Digital Classroom, among others. An important aspect of the program is a focus on the teacher participant’s own classroom, where they, “are called on to define and create parts of the training experience so that it will meet their local needs and make the core concepts immediately useful and relevant to their classroom teaching” (Harris, 2005, p. 3).

One example that fits the traditional professional development criteria is the Maryland Technology Academy (MTA) summer training. One of the primary emphases of the program is aligning high quality lessons to state standards. The over 460 teachers and media or technology specialists that have attended the training from 1999 to 2003 have spent their time collaborating with colleagues to develop authentic materials, receive support upon
completion, reflected on their experience. (Mcpherson, Wizer & Pierrel, 2006). Among the major differences that set this example of traditional professional development apart from the situated model is the set time (summers), face-to-face setup (at the MTA site), not open to all educators (K-12 teachers in the Maryland public school system), and the cost (two funding sources were needed- “a budget allocation to the state department of education from the legislature and a Technology Innovation Challenge Grant (TICG) from the U.S. Department of Education to the Maryland Tech Consortium (MTC)” p. 27).

When teachers have opportunities to participate in professional development programs that are personally relevant, they improve their teaching (Ottenbreit-Leftwich, Glazewski, Newby & Ertmer, 2010). However, there is a lack of models for teachers to use to, “guide them through the necessary changes they will need to be successful in integrating new technology into their classroom” (Keengwe & Onchwari, 2009, p. 216). Teachers who are innovative in the use of technology should be supported so that they could help others to do the same (Keengwe & Onchwari, 2009) in order to increase educational achievement.

Alternative perspectives on technology integration exist, where researchers suggest that, “new educational tools require the development of new instructional approaches relating teaching and learning to the content and context of instruction” (Holmes, Polhemus & Jennings, 2005, p. 382). Also, according to Holmes et al. (2005), researchers agree that situating professional development in teacher classrooms increases technology integration and teacher change, thus making the case for further study into situated professional development models.
The aim of this qualitative multiple case study is to examine teacher situated technology professional development in the middle school setting. The research questions driving the study are:

1. What are teachers’ experiences with situated technology Professional Development programs that help them learn to integrate technology consistent with National Educational Technology Standards for Teachers (NETS-T)?
2. What characteristics of selected situated Professional Development programs help teachers meet their need for self-directed, in-context, time-sensitive training?
3. What limitations of situated Professional Development programs should be improved to better meet teacher needs?
4. What similarities and differences are noted between a course approach and self-guided approach to situated professional development?

**Significance of the Study**

Professional development holds great promise in helping teachers integrate technology in the classroom. The literature on situated professional development is thin, and none of it targets middle school science teachers, and specifically those that have little funding or resources to perform professional development.

Overbaugh and Lu (2008-2009) note that the importance of educational technology teacher training has been recognized in the literature for more than twenty years. The literature on professional development asserts that teachers are more likely to integrate technology into their classrooms when they have opportunities to do so. It is critical for
teachers to use technology effectively in instruction to increase student achievement. Therefore, teachers should understand how to use it in instruction.

This study explored the effectiveness of situated professional development programs and documented the efforts of teachers as they learned. As teachers move further into the 21st century, it will become increasingly important to have high quality, time sensitive, and effective professional development to keep pace with changes in technology. It will also be important for teachers to learn about technology without the funding and resources of their school or district due to budgetary constraints. This leaves teachers with the challenge of learning about technology and integration strategies on their own without a current model to fit this need. This study aimed to study and potentially refine models that bridge the gap between teachers’ technology professional development needs and lack of resources.

**Methodological Approach**

The purpose of this research study was to contribute to the fundamental knowledge of technology professional development and how a situated approach will help middle school science teachers with limited traditional training opportunities. The decision to select a qualitative research methodology was driven by the nature of the research questions. Qualitative methods are particularly appropriate for research questions that are focused more on process than product (Merriam, 2002; Yin, 2009). Qualitative researchers are interested in understanding how research participants make meaning of different occurrences and phenomenon in the world, and through inductive strategies describe the outcomes (Merriam, 2002). The research questions of this study were aimed at exploring how situated technology professional development programs help teachers learn about technology integration and
meet teacher needs for self-directed, in-context, time-sensitive training. The research questions sought an in-depth understanding of a complex phenomenon over which the researcher does not have control (Merriam, 2002; Yin, 2009). The case study method allowed the researcher to retain the holistic and meaningful characteristics of a real-life experience (Yin, 2009). A qualitative case study approach utilizing a collective-case design (Yin, 2009) was used for this study and employed in-depth data collection from multiple sources, including interviews, teacher created artifacts, and surveys to describe the participant experience and find themes (Creswell, 2013). The case study methodologies explained in Yin’s (2009) book, *Case Study Research: Design and Methods* was used to guide the design of this study.

**Limitations**

Although this study sought to provide insights into how middle school science teachers performed situated technology professional development, the following limitations are noted. First, the small sample size of six participating teachers, and focus on two professional development programs, limited the external validity of the study. Generalizability is limited to populations that closely resemble the one studied, and may not apply to other programs of situated professional development. Second, there was bias on the part of the researcher toward technology. When conducting this study, the researcher was a doctoral student in Instructional Technology, therefore a proponent of the usefulness of technology as a tool for teaching and learning. The researcher was also a former middle school science teacher who utilized technology on a daily basis in lesson planning, delivering content in the classroom, and assessing students. The researcher uses technology in his daily
life to complete tasks, communicate with others, and perform work, which includes teaching and taking of courses through the Internet. Third, the data collected for this study was in the form of interviews, review of artifacts, and teacher logs. Interview bias could have been present as teachers may have believed they needed to give the information that the researcher was looking to find. Fourth, this study only involved middle school science teachers in regular education classrooms and may not be representative or generalized to the entire teacher population. Fifth, selection bias may be present due to the fact that the researcher contacted regional Instructional Technology consultants, school principals, and central office personnel to recruit teacher participants. The names recommended to the researcher may be those that were considered more proficient at using technology. Other less motivated teachers who were not selected might not have been as successful with the programs. However, studying proficient users is positive, because if self-training is a problem for proficient users, then it would certainly be problematic for less proficient users. Data from this study should be interpreted accordingly. Lastly, only two out of the six participants in this study completed the assigned Teacher Logs. Additional data may have been taken from these logs, however, the two that were turned in revealed further saturation of data as many of the talking points were covered in interviews. Taking all of this into account, the researcher made every effort to present adequate evidence, from the data, to support this study’s findings.

**Role of the Researcher**

The role of the researcher in this qualitative study was that of data interpreter and, therefore, maintaining awareness of social conditions that affect knowledge acquisition was
critical. In this study, knowledge was grounded in location as well as the social history of the researcher and persons being studied (Mann & Kelley, 1997). Hesse-Biber and Levy (2011) say that this is important because it allows the researcher to be aware of his or her own positionality, his or her place and power within the research process, the ethics associated with research, and how the researcher impacts the research process through the complex dynamics of relationships. As Lincoln and Guba (1985) describe the researcher as the instrument of data collection, we then realize that a researcher does not become a participant in the context being studied and strives to be as unobtrusive as possible so as not to bias any observations. Also, a data interpretation researcher assumes a detached perspective, and watches events or phenomenon rather than taking part. Technology was a useful part of this study’s data collection protocol in the form of audiotaped interviews, recorded and stored data, and analyzed materials.

**Definition of Terms**

**Technology Integration**- any use of computer technology (laptops, iPads, iPods, data projectors, etc.) for the facilitation of classroom teaching and learning (Bauer & Kenton, 2005).

**Traditional Professional Development**- a scheduled class, workshop, seminar, or training held at a particular site with the aim of improving a group of teacher’s general ability to teach or manage a classroom, while all working together (Gaytan & McEwan, 2010).

**Situated Technology Professional Development**- a self-directed class, workshop, seminar, or training aimed at improving a teacher’s ability to create, implement, manage, and teach technology supported lessons that are directly applicable to their own classroom. Most
programs are available online to take part in any time or anywhere the participant chooses (Swan, Holmes, & Vargus, 2002).

**Asynchronous Learning**- a learning experience that takes place online, often in the form of discussion boards or social networking tools, where individuals participants have no restriction of time or place (Merrero, Woodruff & Schuster, 2010).

**Synchronous Learning**- a learning experience that takes place at the same time where individuals meet physically or virtually, often utilizing a physical room, chat room, or two-way conferencing tool (Merrero, Woodruff & Schuster, 2010).

**National Education Technology Standards for Teachers (NETS-T)**- standards used to evaluate the skill, and use of, technology by teachers in the classroom.

**Community of Practice (COP)**- a group of people interested in similar topics and ideas who communicate with one another in order to learn (Cowan, 2012).

**Web 2.0 Tools**- a set of interactive programs and tools used through the Internet for communicating and learning (Oliver, 2010).

**Multimedia**- technology tools that include audio, video, text, or a combination of any of these to create an interactive learning environment (Hernandez-Ramos & De La Paz, 2009).

**Hyperlink**- text or image included in a document or on a website that can be clicked to reveal more information.

**Organization of the Study**

Chapter One provides an Introduction and overview of the study, including the purpose, definitions of key terms, significance of the study, theoretical perspective, and a
brief description of the methodological approach to the study. Chapter Two, the Literature Review, grounds the study in existing and relevant scholarly literature. Chapter Three, Methodology, provides the processes and procedures used to address the research questions, and also a rationale for the research genre guiding the study. Chapter Four, the Findings, presents findings specific to each individual case as well as a cross-case synthesis of findings. Chapter Five, Discussion, expands on significant findings from Chapter Four, then ties them to current theoretical and empirical research literature. Chapter Five offers Implications for practitioners and suggests directions for future research.
CHAPTER TWO: REVIEW OF THE LITERATURE

The purpose of this study is to examine the situated technology professional development of middle school science teachers. Keengwe and Onchwari, (2009) have established that a suitable technology integration professional development model is needed to help teachers better reach young learners.

The purpose of this chapter is to provide a review of the relevant literature. The review is divided into three sections. Section One explores the literature on teachers and technology integration practice and the standards created by The International Society for Technology in Education (ISTE) (2003). Section Two documents the elements of effective teacher professional development on technology and how it might affect change in teacher practice that results in educational achievement. Section Three explores the literature on situated professional development with a description of sample programs and research findings.

Teachers and Technology Integration Practice

Research in the area of technology integration over the last decade provides substantial evidence that computer technology widens educational opportunities for students (Wolfe, 2011; Bauer & Kenton, 2005; Hennessey, Ruthven, & Brindley, 2005), however, many teachers fail to use technology as an instructional tool or fail to integrate it into their classrooms. Technology integration can be defined as the technological tools used in the classroom to motivate students, enhance teacher instruction, make student and teacher work more productive, and allow students to sharpen their digital age skills.
One example of technology integration outlined by Yost (2007) is teachers receiving equipment and training on the use of technology in their classrooms over a three-year period. Teachers in the first year receive a personal laptop, share a video projector with one other teacher, and receive training that helps them integrate these items into their instruction. Second year teachers in this study have a laptop, their own digital projector, access to a cart of laptops for student use, and training that focuses on utilizing the Internet to help foster students’ higher-order thinking skills. Third year teachers have a laptop, digital projectors, access to laptop carts, available still cameras and digital video recorders, and training that focuses on project-based learning utilizing multimedia tools and strategies. The author of the study notes that this started out as a pilot program, but its successful nature has turned into a successful system for integrating technology into the classroom.

Another example of technology integration in the classroom is from Mullen and Wedwick (2008), who used YouTube, digital stories, and blogs in the language arts classroom. The authors highlight that these, “represent simple tools appropriate for any teacher’s use and can easily be used together” (p. 66). They also suggest that being literate in today’s high technology times not only includes the ability to read and write, but also downloading, uploading, ripping, burning, chatting, saving, blogging, Skyping, IM’ing, and share sharing digital content. YouTube is seen by the authors as useful because of the ability to access a large database of free videos that enhances student learning. Teachers in the article site that finding videos to help students understand the word nostalgia is one example of the power of using video, and specifically YouTube, in the classroom. Teachers used
digital stories/storytelling software as a way to narrate student lives or topics they were passionate about, through the use of words, pictures, and possibly music or sound effects. Students noted that telling digital stories allowed them to expand their thinking and taught them how to use many [technology] things. Finally, blogs were used as an effective communication tool that allowed students the opportunity to create authentic writing experiences to share with classmates and the teacher. Writings included book recommendations, discussion and response to current events, and commenting to other student writings. The blogs also served as a way to post student homework, keep a personal calendar, and receive feedback on work. The authors of this study cite that each of these three technology integration tools help students become technologically successful and their use by students helps take necessary steps toward closing the digital divide.

The literature on technology integration suggests that a digital divide exists between students and teachers. Students are categorized in the literature as digital natives who were born in to a world with technology and have grown up using it. Not all teachers have grown up with the same technology and, therefore, require training to integrate technology into their classrooms. Ertmer (1999) studied the first and second order barriers to teacher technology integration. First order barriers are technical or logistical in nature with questions of how to use a piece of technology or when to integrate it. Second order barriers are more of a personal nature and include questions of what might happen if technology fails and the teacher is not capable of handling or fixing problems. Ertmer goes on to say that although teachers are likely to face one of the two types of barriers, it is more likely that teachers will face both first order and second order barriers.
Lawless and Pellegrino (2007) assert that the integration of technology is a complex matter where there are multiple ways in which teachers integrate technology in their classrooms, some more or less productive. According to Perirora-Leon (2010), there is a perceived lack of initiative, on the part of teachers, for integrating technology into the classroom. Hew and Brush (2007) have provided evidence of teachers not using technology because of their feelings and frustrations over the difficulties in implementing technology in a school that does not provide adequate time and resources. In response, teachers will use technology available to them to do what they have always done (Hennessey, 2005), despite claims of any change. A recent U. S. survey suggests that teachers use technology in their classrooms (Project Tomorrow, 2008), however a majority of these uses are, “administrative and communication tasks (e.g., communication with colleagues or parents) as opposed to instructional ones” (Ottenbreit-Leftwich, Glazewski, Newby & Ertmer, 2010, p. 1321).

Teachers are not making the connection between technology training and their classroom curriculum, and are not prepared to use the technology tools given to them (Keengwe, 2007). Although statistics show improvements in access to Internet and computer technology in schools, teacher data shows a decline in the use and integration of these same technologies (Wachira & Keengwe, 2010). Research also suggests that some teachers take up to five years to master technology (Ertmer, 2005), yet 46% of teachers leave the classroom within their first five years of teaching (Barnes, Crowe & Schaefer, 2008). Although technology continues to evolve and shape society, classrooms are slow adopters and the teacher continues to be the focal point, despite having the most important and distinctive effect on student achievement (Hoxby, 2004).
The International Society for Technology in Education (ISTE) (2003) has created five National Educational Technology Standards and Performance Indicators for Teachers (NETS-T). Each of these standards calls for teachers to use technology in ways that promote critical thinking, reasoning, and problem-solving skills. These standards are designed to serve as benchmarks for the meaningful use of technology in the planning, delivery, and assessment of learning experiences. These standards and performance indicators also delineate how technology must be used to enrich professional practice. The standards are:

1. Facilitate and Inspire Student Learning and Creativity. Teachers use their knowledge of subject matter, teaching and learning, and technology to facilitate experiences that advance student learning, creativity, and innovation in both face-to-face and virtual environments.

2. Design and Develop Digital-Age Learning Experiences and Assessments. Teachers design, develop, and evaluate authentic learning experiences and assessments incorporating contemporary tools and resources to maximize content learning in context and to develop the knowledge, skills, and attitudes identified in the NETS-S.


4. Promote and Model Digital Citizenship and Responsibility. Teachers understand local and global societal issues and responsibilities in an evolving digital culture and exhibit legal and ethical behavior in their professional practices.

5. Engage in Professional Growth and Leadership. Teachers continuously improve their professional practice, model lifelong learning, and exhibit leadership in their school
and professional community by promoting and demonstrating the effective use of
digital tools and resources. (p.1)

Research from Franklin and Bolick (2007) emphasize the need for the NETS-T
standards to prepare teachers to use computer technology to better teach content area
curriculum, use as assessment tools for students, and enhance overall professional
productivity. However, a dissertation study from Sam (2011) investigated urban
middle school teachers’ self reported competency in regards to the NETS-T standards, and
results showed that 72% of the 18 focus group participants self reported no knowledge of the
NETS-T standards.

So, despite the call for greater use of NETS-T standards by teachers, it is apparent
that further professional development programs that influence teacher understanding and
application of these standards may be necessary.

**Teacher Professional Development on Technology**

Teacher professional development is, “critical to ensuring that teachers keep up with
changes in statewide student performance standards, become familiar with new methods of
teaching in content areas, learn how to make the most effective instructional use of new
technologies for teaching and learning, and adapt their teaching to a shifting school
environment and increasingly diverse student populations” (Lawless & Pellegrino, 2007, p.
575). However, research continues to find that teacher professional development is
inadequate, in spite of a national focus on its importance (Ansell & Park, 2003).

A large factor in the effective integration of technology into teaching and learning is
professional development, which is critical for supporting teachers’ use of technological tools
(Higgins & Spitulnik, 2008). However, according to Hennessy (2005), new investments in technology have not been followed up with the support teachers need, such as time and resources to create new lessons. Further, current curriculum, assessment frameworks, and policies both, “encourage and constrain teachers in using technology in the classroom” (Hennessy, 2005, p. 159).

Recent research in the area of teacher professional development on technology is very limited and, “noticeably weak in regards to drawing conclusions about what makes a difference” in classrooms and on student achievement (Lawless & Pellegrino, 2007, p. 578). Schools tend to struggle with the establishment of high quality professional development plans that effectively integrate Instructional Technology (IT) into teaching practices (Gaytan & McEwan, 2010) that are guided by best practices found through research (Lawless & Pellegrino, 2007), and typically focused on student-centered learning (Coppola, 2004). The literature on technology professional development for teachers reveals the need for further understanding of effective methods of practice with respect to the various impacts on teaching and learning (Lawless & Pellegrino, 2007).

Different models of technology professional development have been attempted in schools with differing success. Some of these models are outlined below.

**Workshop Models**

Workshop models (Keengwe and Onchwari, 2009; Miners, 2009; McPherson, Wizer, and Pierrel, 2006) often include a set time and place, introduce new technology tools and assist teachers in creating lessons utilizing them, and have mentor teachers oversee the facilitation of training. Though this model was effective in introducing teachers to new
technology tools, in the case of Keengwe and Onchwari (2009) it also brought forth many challenges of technology integration, including the lack of time and resources, technological knowledge, and motivation to incorporate into existing classroom instruction and curriculum. Brinkerhoff (2006) experimented with a technology academy where teachers attended 15 days of in-service training in two years. Although participants made positive changes in their technical skill and confidence in using technology, there were no significant gains in understanding or implementation of a student-centered classroom where project-based learning was an emphasis, despite stipends, free instructional resources, and principal and superintendent endorsements.

Another study from Ireh (2006) focused on investigating an 18 participant workshop model where there was two weeks of intensive summer training followed by full day workshops two Saturdays out of the month in the fall and spring. Participants developed, implemented, and assisted peers in evaluating lessons and resources. The researchers were surprised to find teachers formed partnerships and networks of colleagues for peer feedback and future support. Matzen and Edmunds (2007) describe a workshop model where teachers are placed in the role of students where they complete student-centered, constructivist activities during a one week period. The teachers were instructed by the Centers for Quality Teaching and Learning (QTL) and the activities modeled the integration of theory and practice with technology. Follow-up training included two full days of training administered sometime throughout the academic year. Results show that technology integration after the workshop was on par with teacher beliefs of their own integration skill. When teachers believed they were constructivist teachers incorporating technology, the implementation of the technology rose.
Product and Assessment Approaches to Professional Development

Product and assessment professional development models have teachers create products or artifacts based on technology tools, pedagogy, and/or integration practices learned through a training experience. Graham, Tripp and Wentworth (2009) used this model with pre-service teachers to create a unit plan of lessons that utilized technology while the students were completing their studies in classrooms. The researchers found that pre-service teachers did not use the technology skills learned to go beyond utilizing technology for presentation purposes only, and did not put technology into the hands of students in the classroom to facilitate more meaningful learning.

Hawley, Benavides, Duffy, Georgi, Guay, Redmond and Richmond (2003) examined a teacher preparation institution in California working on a Preparing Tomorrow's Teachers to use Technology (PT3) program as a product and assessment model and describe the portfolio approach taken at the University of San Francisco. A group of pre-service teachers produced final new state technology credentials. The portfolio development project spanned three semesters, starting with a "boot camp" to introduce basic technology skills, a two-credit hour course covering technology integration, a portfolio review during the semester of student teaching with feedback on missing elements and opportunities for revision, and a one-credit hour course during which they finalize their portfolios with examples from their teaching experience. It was found that portfolios style project was a positive form of product and assessment due to the small institutional setting, ease in reaching consensus, and a set of shared goals. The researchers point out that similar results should be expected for larger institutions.
Course Approaches to Professional Development

The course approach is another of the professional development models used in education. Polly (2006) highlights a forty-five hour face-to-face course that involved teachers learning from instructors who modeled integration, working with partners to investigate strategies, and designing classroom lessons that incorporate technology. The study found that teachers left the course with more knowledge on how to use technology and how to incorporate it into lessons. Jones, Fox, and Levin (2011) write of a professional development program involving 12 middle schools where teachers enrolled in a graduate-level course to learn about integrating Web 2.0 tools, whiteboards, and other media elements. Technology coaches worked with teachers outside of the course to assist in integrating their knowledge into their specific classroom. Results revealed that student technology skills and standardized math scores improved in the classrooms where teachers participated in the training.

Case studies are a common model for evaluating the course approach to professional development. Brantley-Dias, Kinuthia, Shoffner, deCastro, and Rigole (2007) write of their study of alternative licensure where pre-service teachers enrolled in a technology for educators course reported that they were able to sharpen their ideas of technology integration. Teacher participants also exhibited growth in their understanding of technical skills and technology integration practices, along with pedagogical content knowledge and the ability to reflect and participate in a community of practice.

Learning Community Approaches to Professional Development

A learning community is another way for teachers to perform technology professional development. This model typically involves a Community of Practice (COP) where like-
minded individuals gather and learn together. With the expansion of Web 2.0 tools and access to the Internet, more teachers are leveraging technology to form groups online who take advantage of on-demand and asynchronous learning. In their mixed methods study of mostly science teachers involved in NASA Explorer Schools online short-courses, Marrero, Woodruff, Schuster and Riccio (2010) found that in-service teachers viewed the experience as an effective way to perform technology professional development. Teachers indicated that the interaction with other educators across the United States was valuable, that live interactive learning was critical in understanding new concepts, and that the flexibility of the courses led to positive attitudes toward the experience.

In their recent work, Jones, Fox, and Levin (2011) highlight communities of practice as groups who address shared community interests, encourage collaborative activities and discussions, and create resources out of the shared interest. Two sample learning communities in the study are highlighted as having gains in student achievement. One community, which focused on teachers trained in math utilizing appropriate technologies through an online course, who were then encouraged online to meet in-person for further collaborations with peer teachers not in the community. The other community, in a separate state, focused on math but also received professional development, access to instructional coaches, and community discussions.

The models of technology professional development outlined above can be categorized as either traditional or situated. Traditional models are characterized by their location, timing, availability, and focus. The location of most traditional professional development programs is at the school site or one physical location where all participants
must travel to attend. Schools often have a designed location, such as the school library where all teachers gather. Timing of the programs tends to be after school when students have left campus and teacher duties are complete. Trainings often occur during the school year, but can also happen during the summer. Many trainings are one to two hours in length, but are also longer if time allows. The availability of traditional professional development programs is dependent on the needs of the school and teachers and who is performing the training. Professional development is performed by private organizations such as the National Science Teachers Association (NSTA), businesses, university partners, or peers within a school district. Professional development funds, when available, come from different district, state, or federal sources, including grants. The focus of traditional professional development programs is often general, so as to reach a wide-ranging teacher audience. Specific curriculum, content areas, integration strategies, and implementation plans are left to individual teachers to work through.

Situated professional development models are defined by many of the same characteristics (location, timing, availability, and focus), however in a different manner. Location of situated models tend to be in a teacher’s classroom and during the school day. Teachers are able to leverage technology to “meet” online with other teachers or participate in a program individually through the Internet. Timing is flexible and teachers are able to participate when their schedule allows because of the tendency of programs to be asynchronous in nature. Availability of the courses are open to educators who have the opportunity, equipment (Internet, computer, software, etc.), and motivation to learn. Situated professional development programs tends to be more focused than traditional programs, with
a variety of programs easily accessible online. A simple search will reveal situated professional development options for most content areas (language arts, math, science, social studies, etc.) and a variety of concepts (technology integration, pedagogy, content, etc.).

Table 1 highlights some of the key similarities and differences between traditional and situated professional development.

A list of criteria for professional development programs is listed in Table 1 below.

Table 1: Professional Development Program Criteria

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Traditional Professional Development</th>
<th>Situated Professional Development</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location</td>
<td>On-site, physical place</td>
<td>Online, anywhere with Internet connection</td>
</tr>
<tr>
<td>Timing</td>
<td>Set time, after school or summer are popular, all participants present</td>
<td>Anytime, often asynchronous, may be completed individually or with a group</td>
</tr>
<tr>
<td>Availability</td>
<td>Restricted to educators who have access to programming, instructors, and funds</td>
<td>Open to educators with proper equipment and Internet access</td>
</tr>
<tr>
<td>Focus</td>
<td>General teacher audience, all participate whether focused on their content area or not</td>
<td>Specific teacher audience, participants find the programs tailored to their content area</td>
</tr>
</tbody>
</table>

The next section highlights models and benefits of situated professional development, and summarizes existing research on situated professional development.
Situated Professional Development

The undesirable results of traditional professional development programs have led researchers to investigate alternative approaches, such as situated models (Swan, Kratcoski, Mazzer & Schenker, 2005). Situated professional development is one new way for, “teachers to overcome the common barriers associated with technology integration and improve their use of technology for instruction” (Kopcha, 2012, p. 1110). Traditional forms of professional development (e.g. university classes, short-term workshops, and in-service trainings) are ineffective and not connected to classroom curriculum (Mouza, 2006). Kopcha (2012) adds that traditional professional development, “lacks connection to actual classroom practice (e.g. stand-alone workshops) or focuses solely on technical skills” (p. 1109). Mouza (2006) also makes a case that high-quality professional development should take place in individual classrooms and outlines several characteristics of high-quality professional development from the literature, one of them being opportunities and trainings that are relevant to teacher needs.

Specific Situated Professional Development Programs

Situated professional development programs that exist in the literature vary widely. A literature review was performed to find situated professional development models that fit six criteria: (1) free, (2) available online so teachers could access it anywhere and at anytime, (3) open to all educators, (4) takes 12 weeks or less to complete, (5) can be completed anytime or anyplace, and (6) aligns with the ISTE NETS-T standards for technology competency. The researcher used the ERIC (Educational Resources Information Center) database of scholarly articles, Google Scholar, and an open Google search with the terms ‘professional
development,’ ‘technology,’ ‘integration,’ and ‘education.’ All searches were performed from October-December 2012. A list of models that were found appears in Table 2 below, along with how they do, or do not meet the specific criteria.

Table 2: Technology Integration Professional Development Models

<table>
<thead>
<tr>
<th>Program</th>
<th>Free</th>
<th>Online</th>
<th>Open to educators</th>
<th>12 weeks or less to complete</th>
<th>Can be completed anytime</th>
<th>Aligned with NETS-T</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intel Teach to the Future</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Edutopia</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>NASA ePDN - Electronic Professional Development Network</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Epic-Ed</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>International Computer Driving License (ICDL)</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Google Teacher Academy</td>
<td>Yes (pending acceptance)</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Teacher Tech Training (T3)</td>
<td>One module</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Discovery Education</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>ISTE</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>
One situated example is Intel Teach to the Future (http://www.intel.com/content/www/us/en/education/k12/intel-teach-ww.html), whose aim is to support teachers in the integration of technology in the classroom. The online program has more than forty hours of training, broken into ten modules that can be completed from one to ten weeks any time the participant chooses, and ends with a capstone evaluation (Harris, 2005). Module choices range from Thinking Critically With Data to Assessments in 21st Century Classrooms to Collaboration in the Digital Classroom, among others. An important aspect of the program is a focus on the teacher participant’s own classroom, where they, “are called on to define and create parts of the training experience so that it will meet their local needs and make the core concepts immediately useful and relevant to their classroom teaching” (Harris, 2005, p. 3). Research and evaluation of the program has found that it, “is a rigorous research-based program that incorporates the best practices in the professional development field… is closely aligned with NCLB’s exacting criteria for high quality professional development and… is an effective professional development experience” (Harris, 2005, p. 2).

Edutopia’s Technology Integration Guide (http://www.edutopia.org/technology-integration-guide) is an online program that assists teachers in better understanding technology integration and project-based learning. It is designed to be used either after completion of the Edutopia.org Project-Based Learning Guide (http://www.edutopia.org/project-based-learning-guide) or with teachers who are familiar with project-based learning. The original design for the guide is for a two- to three-hour class or session, however, can be used in conjunction with trainings on technology used in classroom settings.
The George Lucas Educational Foundation’s (GLEF) Edutopia site offers, “free teaching modules developed by education faculty and professional developers… used as extension units in existing courses, or can be used independently in workshops and meetings… each module includes articles, video footage, PowerPoint presentations, and class activities… [that] draw from the wealth of GLEF’s archives of best practices” (Annan, 2004, p. 305).

NASA's Electronic Professional Development Network (ePDN) (https://nasaepdn.gatech.edu) is an online professional development certificate program free to all K-12 teachers that aims to enhance teachers’ instructional skills, meet professional development goals, and help find new resources to use in the classroom. Teachers have the option to submit courses to their school system for Continuing Education Units. NASA ePDN provides courses for teachers to participate at their own pace and focus on one content area.

Epic-ed (2012) (https://www.epiced.org) is an online community of practice dedicated to assisting schools in the digital transition from a teacher-centered environment to a learning centered one. Epic-ed offers administrators, teachers, instructional technology facilitators, and chief technology officers an online community of support, answers to digital transition questions, tracking of progress, opportunity to browse other school and district profiles to make contacts with others making the transitioning, free and downloadable resources, and participation in live events.

The mission of Epic-ed (2012) includes a national online community of practice (OCoP) that strives to, “provide a dynamic environment for educators to collaborate, share
their expertise, and have access to resources to strengthen their ability to plan, implement, and sustain technology-enabled learning initiatives” (n.p.).

The International Computer Driving License (ICDL) (http://www.icdlus.org) focuses on improving classroom teachers’ computer using skills, including word-processing, spreadsheets, and surfing the Internet (Abuhmaid, 2011). Participants must pass all seven learning modules to obtain the ICDL by demonstrating practical proficiency in each of the computer skills categories outlined. In his study, Abumaid (2011) found that a large portion of teachers (76.5%), “reported developing computer skills (e.g. Word processing, presentation and accessing to information)… [h]owever, only 58 (50.4%) reported developing pedagogical skills” (p. 200) from the training.

“ICDL is a subsidiary of ECDL Foundation, the non-profit certifying authority of the ICDL / ECDL program. ICDL US was established to manage the accreditation of a growing network of ICDL Accredited Test Centers. ICDL works with communities, local and regional authorities, national governments, international bodies, and non-governmental organisations (NGOs), to deliver its ICT skills certification programs across the region. The ECDL Foundation’s certification programs have been delivered to over 12 million people, in 41 languages, across 148 countries, through a network of over 24,000 test centers. Our certification programs are designed to be accessible to all citizens, irrespective of age, gender, status or ability” (About ICDL US, n.d.)
The Google Teacher Academy (http://www.google.com/edu/programs/google-teacher-academy/) provides a free two-day professional development experience aimed to help educators whose applications have been accepted from around the world get the most from Google’s innovative technologies. During the event participants get, “hands-on experience with Google's free products and other technologies, learn about innovative instructional strategies, receive resources to share with colleagues, and immerse themselves in a supportive community of educators making impact” (Google, n.d.). Around 50 educators from around the world are chosen to attend the training, and include; classroom teachers, curriculum specialists, technology advocates, librarians, administrators, professional trainers, and other education professionals. Selection is based on the merits of an online application, as well as professional experience, demonstrated passion for teaching and learning, and examples of successful use of technology in school settings. A priority is also set on participants interested in actively providing mentoring or training for other teachers.

Teacher Tech Training (T3) (http://www.teacher-tech-training.com) is a website with the goal of giving teachers the resources they need to use technology with their students. The T3 online course grew out of a workshop for elementary school teachers into a community building site that allows for participants to engage with other teachers as they learn more about technology tools available to educators. T3 training courses focus on free technology tools (where possible), that are web-based with no installation, and how to use them in the classroom. There are two categories of courses available – (1) short, introductory lessons that learners can go through for free at their own pace online, and (2) a 10-week course led by a tech trainer with interaction among learners and feedback from the instructor and carry a fee.
to attend. Current course offerings include; Why Use Web 2.0 Tools in the Classroom?, How Can I Use Web 2.0 Tools in the Classroom?, and Which Web 2.0 Tools Should I Use? Other courses can be taken for a cost.

Discovery Education (http://www.discoveryeducation.com/administrators/professional-development/index) offers a variety of professional development options for individual teachers, schools, or districts. Packages include an on-site one-day technology professional development training, multi-year tiered experiences, and a customized mix somewhere in between. All offerings are facilitated by one, or many, of Discovery Education’s expert instructors. The courses assist teachers in mastering the use of Web 2.0 applications, Google Tools, multimedia presentations, digital storytelling, and interactive presentation tools. The courses cost several thousand dollars for a live facilitator, or available online as a set of three separate courses for several hundred dollars.

The International Society for Technology in Education (ISTE) (http://www.iste.org/store/webinars), who created the NETS-T standards for teachers and students, have online webinars for teachers who are interested in just-in-time professional development. All of the one-hour sessions are developed and delivered by leading education technology experts in the field of technology integration (International Society for Technology Education, n.d.). “Topics range from social networking and online learning to the latest technology tools and the NETS” (International Society for Technology Education, n.d.). Teacher participants may view live webinars on Wednesday’s at 4:00pm Pacific time, or browse the archived list to view a topic that is of interest when time is most convenient.
Prior Research on Situated Professional Development

In this study, I researched the Intel Teach to the Future program and the Edutopia program, as these were the only two to meet all of the situated professional development criteria listed in Table 2. In this section, I present the results of a literature search on prior research and evaluation findings about these two programs to better situate my own research.

Part of the mission of Intel Teach to the Future is helping teachers to use technology with students. In their report, Martin and Shulman (2006) compared more than one thousand K-2 teachers, half of whom participated in Intel and half who did not. They looked specifically at three factors—participation in a quality professional development program (Intel), pedagogical beliefs, and access to technology. The researchers found that participants integrated more technology into their lessons and also used technology with students more often. The program was noted as creating, “dramatic changes in the behavior of teachers who held weak, rather than strong, constructivist beliefs” (p. 3). Non-participating teachers described how they used technology in their classrooms with the top responses including: emailing teacher colleagues and administration, grading, creating handouts, and accessing the Internet to find help creating lessons and activities. However, Intel participants cited uses of technology to access CD-ROMs to aid lesson creation, create alternative assessments, present information to students, adapt activities to students’ needs through a computer, analyze data to inform practice, and create original handouts.

Another report from the Education Development Center (2006) on Intel Teach to the Future found Intel reaches less affluent schools in the United States. Of the 1,178 participants identified as Master and Participant Teachers who were surveyed online
throughout the United States, English teachers participated in Intel most, followed by math and then science. Over eighty percent of respondents to the survey implemented the unit plan they created during their training and nearly ninety percent of teachers reported using technology “in new ways” (p. 2) with students following Intel training. According to the article a majority of teachers (64%) believed their Intel training was “relevant to teaching goals” (p. 2) and responded that they used several specific project-based strategies in their classroom after training. Teacher respondents also remarked that the biggest challenge to technology integration was lack of access to computers and lack of time.

Martin, Mandinach, Kanaya, and Culp (2004) found positive results from Intel Teach to the Future when surveying teachers from four different countries (including Taiwan, Japan, India and the U.S.). Findings from the surveys indicated teachers utilized project-based learning techniques learned in the training, and integrated new lessons that incorporated technology. Martin et al. (2004) also found, “strong relationships between access to technical resources and rates of implementation, and an equally strong relationship between teachers’ perception of the relevance of the project-based teaching strategies presented in the training and rates of implementation” (p. 3).

Light (2009) examined six schools in Turkey, India, and Chile to study any influences the Intel Teach to the Future professional development had on the classroom learning environment. The researcher found three common themes among the schools in the study: changes in knowledge, beliefs, and attitudes about technology; deepened understanding of student-centered practice; and overall improvement in information and communication technologies. Teachers from Chile and Turkey emphasized that,
“professional development opportunities helped them use [information and communication technologies] in their classrooms and apply what they learned from the [Intel] Course to their practice” (p. 63).

One sixth grade Language Arts teacher motivated students to present their literary work using technology for the first time after modifying an existing lesson while working through Intel Teach to the Future (Nudell, 2004). The teacher, “rarely used technology in her teaching or asked her students to do so,” but Intel changed her practices (p. 51). The article reports that Intel Teach to the Future gave the teacher an opportunity to find out how to incorporate technologies the teacher did not know about into classroom lessons, how the “Internet could be a valuable resource for lesson planning and creating lessons focused on student-driven inquiry, or how… word processing skills could be built on to explore other publishing software programs, giving [the teacher] more options for integrating technology into… lessons” (p. 51). Nudell (2004) states that treating teachers as active learners, providing opportunities to collaborate with peers, and training over an extended period of time are some of the qualities that make Intel, and professional development in general, a productive learning environment for teacher participants.

A literature search of the ERIC, Academic Search Complete, and PsychInfo databases using the keyword "Edutopia" brought 43 results. Out of the 43 results no articles examined the Edutopia Technology Integration Professional Development Guide or studies that utilized aspects of the Edutopia.org website for professional development purposes. The Periodicals, Academic Journals, Books, Reviews, and News from the search results discuss the Edutopia.org website, George Lucas and his educational foundation, or
other topics related to the word Edutopia.

The studies outlined in this chapter either report on the results from teachers who participated in Intel Teach to the Future or describe their experiences of the program, as a whole. This study documented the experiences of three middle school science teachers as they participated in the Intel program, and then compared those experiences with three teachers who participated in Edutopia. Comparing the experiences of teachers who went through a course approach (Intel) to a self-guided approach (Edutopia) deepens the understanding of what helps teachers better perform situated technology professional development.
CHAPTER THREE: METHODOLOGY

The aim of this qualitative case study was to examine teacher situated technology professional development in the middle school science setting. The research questions driving the study were:

1. What are teachers’ experiences with situated technology professional development programs that help them learn to integrate technology consistent with National Educational Technology Standards for Teachers (NETS-T)?

2. What characteristics of selected situated professional development programs help teachers meet their need for self-directed, in-context, time-sensitive training?

3. What limitations of situated professional development programs should be improved to better meet teacher needs?

4. What similarities and differences are noted between a course approach and self-guided approach to situated professional development?

Research Design

To gain an in-depth understanding of teacher situated technology professional development, this study used a qualitative methods design. The following sections outline the purpose and rationale for each aspect of the study.

Qualitative research designs attempt to understand human behavior and investigate the why and how of decisions and experiences. Qualitative research is a method where the research is focused on a situated activity where the researcher is located in the world (Denzin & Lincoln, 2011). Additionally, qualitative research begins with assumptions and moves into
using frameworks and theories for interpretation of problems and people being researched (Creswell, 2013).

Case study research explores real-life phenomena over time, and includes in-depth data collection from multiple sources (interviews, field notes, anecdotes, etc.) to describe an experience and find themes (Creswell, 2013). Specifically, this study utilized a collective case study method where one issue was selected, in this instance teacher situated technology professional development, and the researcher selected multiple cases to illustrate the issue. The benefit of such a design is to show different perspectives on the same experience. Also, as Yin (2009) suggests, the logic of replication in which the researcher follows the same procedures for each case strengthens the collective case study method.

**Participants**

To examine teacher situated technology professional development in the middle school setting, six middle school (grades 6-8) science teachers from districts identified as having limited funds and programs for professional development were selected to participate in this qualitative study. Mid-career teachers with at least three years teaching experience and at least a self reported basic understanding of technology integration were recruited for the study (e.g., background training with tools such as laptops or mobile devices, software training such as word processing and assessment, and/or technology integration training such as with the above mentioned tools and software together). Participants in this study noted training in these areas, and also opportunities to train others. Having participants with this background ensured that the results would not be skewed by participants struggling with the
basics of teaching or technology use while simultaneously trying to learn the concepts in the professional development program.

Participants were drawn from three middle schools, with two science teachers from each location recruited to go through the professional development training. One teacher at each site was assigned to the Intel condition and the other to Edutopia. Each teacher worked through one of the selected programs, sat for an interview at the halfway point of their program, and then sat for a focus group with the other teacher from the same location.

Materials

Two professional development programs were chosen for this study, as they met all of the identified criteria for situated professional development: (1) free, (2) available online so teachers could access it anywhere and at anytime, (3) open to all educators, (4) takes 12 weeks or less to complete, (5) can be completed anytime or anyplace, and (6) aligns with the ISTE NETS-T standards for technology competency. The two programs selected for this research study are outlined and explained in detail here.

Intel Teach to the Future

(www.intel.com/education/teach)

Intel Teach to the Future is a structured online self-study course with opportunities to engage in a community of learners who are either working through the same program or have already completed the courses and are available to help others. Participants in the Intel Teach to the Future courses learn about 21st century technology tools and complete an Action Plan to integrate new strategies into their specific classroom,
content area, and curriculum. Intel provides opportunities for small group discussion and Action Plan sharing through their Teachers Engage website (engage.intel.com), a private community for teachers working through the Intel program. Course topics include, Thinking Critically with Data, Assessment in 21st Century Classrooms, Project-Based Approaches, Educational Leadership in the 21st Century, Collaboration in the Digital Classroom, Inquiry in the Science Classroom, and Designing Blended Learning. Teachers use their existing curriculum to prepare engaging lessons centered on students’ problem-solving ability, critical thinking skills, and collaboration techniques that incorporate existing digital content, Web 2.0 tools, and other online resources. Participants work through course material and their Action Plan online with the help of animated tutorials, interactive learning exercises, and offline activities designed to apply concepts in the current classroom. Each action plan is different and specific to the course teachers are taking in the program. The courses are fully aligned with the ISTE NETS-T standards and model the process of aligning assessments, standards for learning, and curriculum and instruction. The courses also fall in line with the No Child Left Behind (NCLB) mandates through the focus of state learning standards, utilizing research driven instructional strategies, and aligning assessment, curriculum, and instruction.

Edutopia Technology Integration Professional Development Guide
(http://www.edutopia.org/technology-integration-guide)

Edutopia’s Technology Integration Professional Development Guide is an organized list of stand-alone materials that individuals access and work through on their own. The training is offered by the George Lucas Educational Foundation, which strives to
improve education through documentation and advocacy of educational innovation that utilizes tools that prepare today’s students for success in their adult lives (Edutopia, n.d.). The online technology integration training assists teachers in better understanding technology integration and project-based learning by helping to answer two questions; “Why is technology integration important?” and “What is technology integration?” The program is aligned with the ISTE NETS-T standards and uses Edutopia and scholarly articles, example classroom videos, and other online and offline resources such as books to demonstrate technology integration. Participants navigate the course through links located on the Edutopia website.

Data Collection and Analysis

Descriptions of data, along with rationale, procedures, advantages, and limitations and analysis procedures are presented and discussed in the following sections.

Data Sources

Audio-recorded, semi-structured interviews and focus groups. An audio recording device was used to capture one interview with each teacher participant at the halfway point of their professional development program, and a focus group with each pair of teachers from the same school who went through different professional development programs (one Intel Teach to the Future and the other Edutopia) at the conclusion of all training. The interview protocol forms are included in Appendix A and B.

Teacher-created artifact. During their situated professional development the teacher participants were asked to complete an Action Plan in the process of learning about
technology integration in their science classrooms. The Action Plan was designed to help integrate new technology strategies into teachers’ specific classrooms, content area, and curriculum. A copy of each Action Plan is listed in Appendix C.

**Teacher logs.** Teacher participants were asked to maintain a log where daily or, at minimum, weekly entries were written to document personal experiences. General thoughts, personal anecdotes, challenges, frustrations, or statements of achievement were prompted in the logs and then analyzed by the researcher at the conclusion of the programs to triangulate data and describe experiences. Appendix D has a copy of the teacher log. Teacher logs were requested and collected at the end of the study.

Table 3 below has a list of the research questions and what data sources were used to address each one.

### Table 3: Data Sources Used to Answer Each Research Question

<table>
<thead>
<tr>
<th>Research Question</th>
<th>Semi-structured interviews and focus groups</th>
<th>Teacher logs</th>
<th>Comparison of teacher-created artifacts to NETS-T standards</th>
</tr>
</thead>
<tbody>
<tr>
<td>Research Question 1</td>
<td>Yes</td>
<td></td>
<td>Yes</td>
</tr>
<tr>
<td>Research Question 2</td>
<td>Yes</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Research Question 3</td>
<td>Yes</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Research Question 4</td>
<td>Yes</td>
<td>Yes</td>
<td></td>
</tr>
</tbody>
</table>

### Procedures

Teachers in this study were recruited on a voluntary basis from schools with limited
opportunities and funds for traditional professional development. A state-level Department of Public Instruction Regional Technology Consultant helped to identify several schools in their region that would benefit from a situated approach. The researcher also contacted several county central office directors of research to identify principals to contact. Once schools were identified, the researcher requested permission from the school principals to recruit science teachers for participation. Once participants were identified, an informed consent document further explaining that participation was voluntary was distributed.

The researcher introduced the two situated professional programs to the teacher participants through online virtual meetings to share the program links, identify program and study timelines, ensure consent forms were collected, answer any questions, and set up halfway point interviews. For participants in the Edutopia condition, there were four sections to complete: (1) Introduction, (2) Why Integrate Tech?, (3) What is Tech Integration?, and (4) Resources for Tech Integration. Each section provided an explanation with embedded links to additional resources, “including articles, video footage, PowerPoint presentations… and class activities which draw from the wealth of GLEF’s archives of best practices” (Annan, 2004, p. 306). It was estimated that each category would take participants one week to complete, and study participants were expected to complete the entire program or all four categories within the study period of four weeks.

Participants in the Intel Teach to the Future condition were asked to choose at least two of six courses and complete one course every two weeks within the study period of four weeks. The six course choices included: Thinking Critically with Data, Assessment in 21st Century Classrooms, Project-Based Approaches, Educational Leadership in the 21st Century,
Collaboration in the Digital Classroom, and Inquiry in the Science Classroom. Within each course there are five modules, and within each module there are three to six lessons with several interactive activities. It was estimated that each module would take one hour with teachers spending additional time outside of the program applying concepts through an assigned Action Plan. The Action Plan is designed to help participants evaluate how they are currently incorporating the skills and concepts in the training and also plan for additional activities in the classroom.

At the halfway point for each of the trainings, the researcher interviewed each teacher participant to find out how they were experiencing the trainings and what their thoughts were while working through them. Once the programs concluded, the researcher conducted a focus group with each pair of teacher participants to perceive how they experienced the programs and gain insight into how the overall experience may impact the research questions. Semi-structured interview and focus group questions focused on the quality of the program, learning outcomes, challenges along the way, and overall feelings toward the program and process.

A timeline for the study is shown in Table 4 below.
Table 4: Timeline

<table>
<thead>
<tr>
<th>Event</th>
<th>Start Date</th>
<th>Time for Completion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introduction of professional development programs</td>
<td>February 2013</td>
<td>Thirty minute meeting</td>
</tr>
<tr>
<td>Program training, Gather teacher logs, and teacher action plans</td>
<td>February 2013</td>
<td>Intel Teach to the Future- 4 weeks Edutopia- 4 weeks</td>
</tr>
<tr>
<td>Halfway interviews</td>
<td>March 2013</td>
<td>Thirty minutes</td>
</tr>
<tr>
<td>Program training complete</td>
<td>April 2013</td>
<td>-</td>
</tr>
<tr>
<td>Program completion focus groups</td>
<td>April 2013</td>
<td>Thirty minutes</td>
</tr>
</tbody>
</table>

Qualitative Data Analysis

Due to the qualitative nature of the study, data were collected in the form of audio-recorded, semi-structured interviews and focus groups, teacher logs, and artifacts and lessons that teachers created during their training.

Audio-recorded, semi-structured interviews, focus groups, and teacher logs.

Audio recordings were transcribed using a computer with an audio player and word processing software. Teacher logs were collected as word-processed files. These data sources were imported into Atlas.ti qualitative software for detailed analysis. Open coding was used to tag data from all of the transcripts. Each participants’ halfway interview was coded and then all of the focus groups. All open codes were analyzed and then combined into similar categories where ideas that were closely related or the number
of codes in a category were too small to be significant alone were put together. Once
categories were derived, broader themes that cut across categories were identified and then
used to answer the research questions. Appendix E provides the full list of codes generated
during analysis, and sorted into categories.

**Comparison of artifacts and lessons that teachers create during their training to**
**NETS-T standards.** Teachers created lesson plans and other artifacts as they proceeded
through their professional development training. These artifacts were analyzed by
comparison to the ISTE NETS-T’s five categories: (1) Facilitate and Inspire Student
Learning and Creativity, (2) Design and Develop Digital-Age Learning Experiences and
Assessments, (3) Model Digital-Age Work and Learning. Teachers exhibit knowledge, skills,
and work processes representative of an innovative professional in a global and digital
society, (4) Promote and Model Digital Citizenship and Responsibility, and (5) Engage in
Professional Growth and Leadership. This comparison helped to identify if the type of skills
teachers were learning or demonstrating matched up with the expected skills from the five
standards.

**Validity and Reliability - Trustworthiness**

Being intentional, and thoughtful, about the data collection and analysis process is the
best approach for addressing concerns about validity and reliability (Merriam, 2002). In this
study, a variety of strategies were used to ensure trustworthiness in regards to data.

First, multiple sources of data (semi-structured interviews and teacher logs) were used
to capture the experience of teachers as they participated in the professional development
training. This ensured that a plausible and holistic explanation of the data could be made (Merriam, 2002).

Second, a member check of all transcribed interviews by the teacher participants ensured the accuracy and intention of any answers (Maxwell, 1996). Teachers were sent a copy of the transcribed interviews and were asked to make any suggestions or changes.

Third, the researcher made every attempt to bracket his experiences while conducting participant interviews and focus groups in order to lessen the impact of personal bias (Merriam, 2002). The researcher is a former middle school science teacher who makes attempts at helping other teachers discover new ways to make themselves better, particularly with the help of technology, to make the classroom experience better for students. However, the researcher made every effort to hold back any assumptions or predispositions in regards to the participant teachers, the context, lessons, or use of technology when interviewing and interacting with the participants. In order to make non-biased decisions or conclusions, the researcher also made every attempt to bracket his own thoughts, feelings, and experiences. This made it possible not to make right or wrong, good or bad, or outdated or modern judgments in regards to the teacher participants' practices. The amount of data collected for this study contributed to the credibility and trustworthiness of the study's findings.

**Ethical and Political Considerations**

Researchers collect and analyze data to describe, or make inferences about, a sample. While attempts were made to remain non-biased, ethical dilemmas can still persist. The qualitative aspects of this study, such as the interviews and participant awareness of the review of artifacts, brought potential risks to participants. Revealing sensitive information
unintentionally, having privacy breached, or embarrassing situations observed are examples. The researcher of this study took special care in revealing only what the participants allowed and made every attempt to ask questions and only 'dig as deep' as the participants were willing to go.

All participant information and data were collected securely, kept confidential, and stored in a password-protected computer. Any identifiable information was encoded and pseudonyms used in place of actual names. All audiotape files were destroyed at the conclusion of the study. Participants were not and will not be referenced in any oral or written report that could link them to the study.

The goal of educational research is to advance the field. Research contributes to the theory and practice of all stakeholders, but also makes its way out to much of the public at large, and may include policy makers, funding sources, and the general public. In considering the political implications of this study, it was understood that the audience for this research is large. It thereby rested on the shoulders of the researcher to follow proper research guidelines in order to conduct an ethical and scholarly study. The researcher was aware of the ethical processes that surround educational research and made every effort to be critical of himself to the highest standard.

**Methodology Summary**

This case study provides a narrative that details the experiences of middle school science teachers. It presents themes that emerged around performing situated technology professional development. This research study contributes to the fundamental knowledge of
technology professional development and how a situated approach can help middle school teachers with few resources.
CHAPTER FOUR: FINDINGS

The aim of this qualitative case study was to examine teacher situated technology professional development in the middle school science setting. Six middle school science teachers participated in this study and utilized two free online technology professional development programs. Participants went through either the Intel program or the Edutopia program, and not both. Individual interviews were conducted at the halfway point of the programs, and then a final focus group paired participants from the same school who had been exposed to different programs.

Table 5 below provides an advanced organizer for the key findings in this study.
Table 5: Advanced Organizer for Key Findings

<table>
<thead>
<tr>
<th>Research Question</th>
<th>Key Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Research Question 1</td>
<td>Both programs did well in addressing each of the NETS-T Standards</td>
</tr>
</tbody>
</table>
| Research Question 2 | Participants felt the programs were relevant, engaging, and helped in creating personalized materials that fit their curriculum and classroom (Intel- Action Pan).  
Participants in this study felt, overall, that the course approach is the better approach to situated technology professional development because it was what they were use to, they appreciated being told what to do in a step-by-step manner, and it allowed them to plan time better because they knew what to expect and how long.  
Participants in this study also noted aspects of the self-guided/paced approach that were valuable, including; providing inspirational models, ideas, and examples through video and example lessons, introduced practical tools, and allowed time for self discovery. |
| Research Question 3 | Programs utilized in this study could be improved through increased socialization with communication between other colleagues and a facilitator for support.  
The programs in this study could also be improved through personalization by adding grade-level/content specific tracks (Edutopia), table of Contents/Direction (Edutopia), and more audio in order to listen while working on Action Plan or other activities (Intel). |
| Research Question 4 | Differences between the two programs included the structure and assessments. Participants noted that Intel was organized and sequential and also provided quizzes and an Action Plan.  
Similarities between the two programs included choice. Participants were able to chose what they wanted to learn and how they would like to learn, and also the time and place where they accessed the programs. |
The next section provides background profiles for each participant.

**Participant Background Profiles**

**Participant 1 (P1)- Edutopia**

Participant 1 was a Caucasian female first year 8th grade science and social studies teacher who received her bachelors degree online. She is an eager adopter and adapter of technology who has completed several self volunteered technology trainings offered at her school and in the county, as a first year teacher. She describes using much, if not all, of the technology provided by the school and also utilizes personal technology such as a laptop and iPhone in the classroom. Participant 1 has the technology savviness to talk with students about a variety of technology topics and the use of most computer hardware. She proclaims a sufficient knowledge of many Web 2.0 tools including video servers such as YouTube and Vimeo, an online Smartboard program to, “replicate the one I have sitting back here [in the classroom],” and document camera software through her iPhone. In regards to describing her knowledge of integrating technology in the classroom, she said:

“I would say that I’m pretty proficient in my knowledge [of technology]. I did kind of grow up in the digital age, in the beginning of the digital age I would suppose. So as technology has evolved I've sort of evolved with it, so not to mention that in college that's uh, they're kind of making that mandatory now, you have at least have three to four technology based classes, it's all about technology now. Not to mention we also have lots of technology available to us at school, we have our document cameras, our projectors, smartboards, TVs, iPads, laptops, computer labs, all that kind of stuff.”

**Participant 2 (P2)- Intel**

Participant 2 was a Caucasian male 7th grade science teacher with 21 years experience as an educator. He is a veteran technology user open to finding new ways to use the types of technology tools and strategies he knows, understands, and trusts. He is a teacher that finds
technology workshops and trainings that suit his skill and understanding level and goes back
to them when available. He also searches out free opportunities and takes advantage of them
when they arise. Participant 2 utilizes traditional and contemporary tools together and allows
students to use what they think is best for each task. For example, students make and take
notes with paper and pencil and then transfer them to an online notebook.

“I don't know that I'm the worst ever [with technology], but I'm probably not as up-to-
date as some other people. I would say midrange somewhere. I like to use technology
in the classroom, I like to use technology that I know. Smartboard, we do Prezi, we
do Voicethread, lots of YouTube stuff.”

**Participant 3 (P3)- Intel**

Participant 3 is an African American male 8th grade science and social studies teacher
pursuing a Masters of School Administration. He is conscious of curriculum and policy
changes and literature on what impacts student achievement when it comes to utilizing
technology. Participant 3 takes advantage of school and county trainings and workshops and
believes that is the most effective and efficient way to participate in professional
development. He also assists in leading trainings at his school and makes presentations on
best practices and technology integration strategies.

“I would describe my knowledge of integrating technology into the classroom to be
rather proficient. I use a lot of technology in my classroom on a daily basis. My
school has been fortunate enough to receive several grants. Which has

allowed us to put computers in every classroom. So I have about six computers
that I use in rotation stations in my classes at least three to four times out of the week,
and that's in addition to having weekly scheduled computer lab time for forty-five
minutes where my students actually go in to a computer lab and do so many of their
assignments online. We also have a number of classes that have, I guess the best way
to put it, is that they have become virtual. And so, they have taken out the desk and
they have put in one computer, one-to-one ratio, I guess is
the term for it.”
Participant 4 (P4)- Edutopia

Participant 4 is an African American male 8th grade science and social studies teacher. He is an early adopter of any technology he is able to get his hands on. He is eager to learn more about technology and how it can impact his teaching and students. Participant 4 leads many school workshops on technology and has attended most professional development opportunities that his school and district have offered. He also has specific areas/topics he is interested in pursuing that are not currently implemented in his classroom, such as game-based learning.

“I feel when it comes to integrating technology into the classroom, I am more than competent, more than capable of doing that within my classroom. I've had a lot of staff development, I've also taken courses on how to integrate technology into the classroom. Then the school that I operate with, we are very fortunate with the level of technology that we have at our school. I have the opportunity to use a lot of technology in my class on a regular basis. We have iPad carts, iPod carts, each classroom at our school has a six-station computer lab within the classroom. Also, every grade level has its own computer lab so every day, well not every day, but once a week each teacher is assigned a lab day where they can use the computer lab for the entire day for all of their classes. We have Smartboards, we have document stations and document cameras.”

Participant 5 (P5)- Intel

Participant 5 is a Caucasian female 8th grade science teacher. She has a good working knowledge of several technologies that are utilized in her classroom. She was one of several teachers in her school to pilot a program using Edmodo as a class website for communication, assessments (formal quizzes and tests), announcements, and resource storage and delineation. She had difficulties with the Intel program and it skipping her to the end of a module without finishing. She needed to change modules to accommodate for the difficulties.
“I think I have a fairly good knowledge base, better, I would say better than average. I try and incorporate a lot of technology when possible into the classroom. GoAnimate is one that I've used, we also do a lot of use with the iPad, we're fortunate enough to have a school that received a technology grant, so we use iPads sometimes during our lab for the kids to take photos and post on Edmodo. I do a lot of conversing and posting on Edmodo.com, sometimes they take tests and quizzes on there, they use Quizzlet as well, as a means to study their science vocabulary, and that's just a few, I can't think of any more off the top of my head.”

Participant 6 (P6)- Edutopia

Participant 6 is a Caucasian female 7th grade science teacher. She uses several technology tools in her classroom approximately one day per week. She emphasizes the freedom to ‘skip around’ as one of the main advantages to online technology professional development. She also says that the Edutopia program has helped her examine the way students learn and given her ideas for how to use technology to change the way students approach their work.

“I've been using technology in my classroom now for about three years pretty regularly, about one day a week. I've used SAS in school, I've used a lot of webquests that I've found online, I like the Zoonall ones, I've used Edmodo extensively this year, I've used videos, streaming videos, I think that's about it.”

Participants 1 and 2 teach at the same school, located in the eastern part of North Carolina. Participants 3 and 4 teach at the same school, located in an economically disadvantaged school in the Piedmont of North Carolina that is part of an Impact grant to infuse technology and training. Participants 5 and 6 teach at the same school in the piedmont of North Carolina, recently constructed in 2008 with modern facilities.

Findings from individual interviews and focus groups along with teacher logs and Action Plans are presented in this section to answer the four research questions. Only two of
Research Question One

What are teacher’s experiences with situated technology professional development programs that help them learn to integrate technology consistent with National Educational Technology Standards for Teachers (NETS-T)?

Interview and focus group questions from this study specifically targeted the five ISTE NETS-T standards and whether the teacher participants felt that their program was effective at incorporating each standard in their learning. Analysis of this research question extended beyond the questions targeting the standards. Each standard is outlined below.

Standard 1: Facilitate and inspire student learning and creativity. All six teacher participants in this study acknowledged that their programs addressed, or partially addressed, this standard. Teachers mentioned that both programs pushed for facilitation and inspiration of student learning throughout their programs, which specifically focused on helping teachers create a student-centered environment as opposed to a teacher-centered environment.

P6 “it was something that was encouraged through the readings…it talks about how to become a facilitator and how to facilitate a classroom more than instruct.”

P4 “Well my program gave multiple examples of different ways to improve technology into the classroom. Different types of assessments to monitor student production…it focused on not being so teacher centered. And making sure that you're using the technology in a manner where the students are the ones creating the product and benefitting from it”

P5 “it gave you a lot of different examples of how to make it more student centered. And allowing [students] to be creative and come up with their own questions and their own answers”
Standard 2: Design and develop digital age learning experiences and assessments.

In regards to the programs helping participants learn to design and develop digital age learning experiences and assessments, one teacher acknowledged that their program addressed this standard, one responded no it did not address the standard, and four teachers responded that it partially addressed the standard. Teachers in this study commented that their programs did have a focus on digital age learning experiences, however an explanation of the designing of experiences and assessment of those opportunities were not sufficient.

P5 “Really, the courses that I did did not have a lot to do with digital age learning … Each of the modules had a piece on assessments, but didn’t mention how to do them.”

P2 “one did a really good job… lots of good checklists and rubrics... But [the other] not as much”

P1 “…depending on which one that you chose, it did a really good job of introducing your resources to design digital assessments”

Standard 3: Model digital age work and learning. When asked if the programs helped teacher participants learn to model digital age work and learning, one teacher acknowledged that their program did not address this standard, while the remaining teachers responded yes or partially. Teacher participants agreed that modeling digital age work and learning is important and all of the teachers gave examples of technology they use and how they use it in their classrooms, however they did not express a feeling that either program went in depth on this topic. Participants gave examples of a single article or part of a module referenced digital age work and learning, but did no more than that.

P4 “My program did a pretty good job of modeling digital age work and learning…They gave different programs to use, they gave you directions on how to specifically incorporate and use those programs, and then they gave you samples on how those programs operate.”
P5 “I wouldn't say a large part of any of the courses that I saw said a whole lot about modeling digital age work.”

P1 “As far as I'm concerned it really didn’t introduce anything [about that].”

**Standard 4: Promote and model digital citizenship.** One teacher participant acknowledged that their program did not promote or model digital citizenship, while the remaining teachers responded “yes” or “partially.” Participants who responded yes to the question about promoting and modeling digital citizenship pointed out several places in their program where this was referenced and recalled many examples that were given to explain this topic.

P1 “my program had a large focus on promoting digital citizenship and it had a lot of lessons…”

P2 “It did address it and it did tell you what to do as far as classroom management issues, what to put into rubrics, they definitely showed it through example, so if you implemented what they were telling you to do, the students become better citizens.”

**Standard 5: Engage in professional growth and leadership.** In regards to engaging in professional growth and leadership, one teacher acknowledged that their program did not address this standard, while the remaining teachers responded “yes” or “partially.” Of the teachers who responded “yes,” several of them felt inspired, by their program, to do more and to do better in their classroom where using technology is concerned. Teachers also mentioned that the resources that were included in the programs were helpful enough to pass along to colleagues and other educators.

P4 “my program did more to inspire me to want me to do it, but the actual program itself really had more of a focus on things that that teacher was doing in the classroom, and different ideas for that teacher to incorporate technology into the classroom…They gave you examples of what other people and others schools and other classes were doing, and as an inspiration that would drive me for more professional developmental technology.”
P5 “I feel like it really did a good job…the way that it was laid out. It was very engaging… It really kind of gave me more confidence in certain areas of collaboration and branching out.”

P1 “I think these programs really help…I think that this program has really opened a lot of resources that would be beneficial to some of our colleagues…”

**Research Question Two**

*What characteristics of selected situated professional development programs help teachers meet their need for self-directed, in-context, time-sensitive training?*

Three categories of characteristics emerged from the data to inform research question two: general 21st Century characteristics, course characteristics, and self-paced characteristics.

**General 21st Century Characteristics**

The teacher participants in this study described several 21st characteristics of their programs that helped them perform situated technology professional development. Teacher participants emphasized that the programs were relevant to what and how they were teaching in the classroom, provided inspirational example lessons and material that helped them visualize how to incorporate technology better into their teaching, and delivered resources that assisted them in creating personalized materials to fit their specific curriculum and classroom. Each of these characteristics is detailed below.

**Engaging.** A common theme that ran across all of the participants was the idea that both programs were engaging. Teachers responded that both programs kept them interested in learning and wanting to come back quickly whenever they had to stop. They mentioned multimedia as one of the most engaging aspects of the programs. There were videos in
Edutopia and audio-visual aspects of Intel that helped to keep their attention. Participants also mentioned the programs provided targeted resources that allowed them to have choice in what they were doing. Articles with hyperlinks allowed participants to choose what they clicked on and the path they took through the program and Intel provided six separate modules covering several topics.

P6 “I just seem to have more energy and motivation to do it. It was very interesting, it was very current, and very targeted. I could target it to what I wanted it to be, which I enjoyed. There was a ton of stuff to pick from. Which was good, I liked that… There's a lot of resources to share, actually.”

P3 “it's very straightforward and to the point. Almost as if it were designed specifically for that reason. That there's not a lot of extra stuff, not a lot of fluff…So I think that's worked out really, really well with the activities and the videos and the lighting and the little blurbs.”

P2 “…it let's you choose what you think your students are ready for and what you're ready for…”

P5 “I feel like it really did a good job, the way that it was laid out. It was very engaging, took you through different scenarios, different ways to incorporate community and parents. It really kind of gave me more confidence in certain areas of collaboration and branching out.”

**Inspirational Models.** Teacher participants responded that the programs were inspirational and provided examples that inspired them to do what they were doing, better. Participants were also inspired to use new programs and new teaching strategies and mentioned using many of them in future. One Intel participant responded that he will proceed with more of the learning modules and shared the program with a sibling who is also a teacher and has plans to participate.

P3 “I've [been] saying, 'oh, I can take this from here and do this and do this.' And really start mapping out some different activities than just the regular…[now] I can say, 'construct something like this, go to this website and watch an animation and tell me what did you learn about this or what did you do about that?' … have them to take
it to the next level. And that's what's really been exciting to me is that I can choose some new ideas about how to do some things…”

P6 “I got some really good, new ideas of lessons. They offered a lot examples, like Storyboards, that I had never heard of. But there were a bunch of different examples and lessons that you could do. I definitely plan to use Storyboard in the future.”

P1 “…I know it’s gonna change my teaching, I know it’s gonna make me better.”

**Creating Personalized Materials.** Participants in this study who worked through Intel Teach to the Future were asked to complete an Action Plan during the program. The Action Plan was designed to help Intel participants put all their learning into action in their classroom using their curriculum. All three Intel participants remarked that the Action Plan is a valuable part of the program and helped to put ideas into classroom action.

P5 “I think that the Action plans were the key for the entire course. I don't think it would have been the same had it been just watching the videos and going through the lessons. By doing the action plans, it allows you to think critically about how you are going to apply what you learned in the classroom.”

P3 “The Action plans actually greatly benefitted me. I guess being able to reflect on what I was learning. Being able to write and transcribe a real plan of how would I incorporate this into what I'm doing. How to put it down and actually really help and get all of those ideas together.”

P2 “The Action Plan was a good idea.”

**Characteristics of the Course-Approach (Intel)**

A majority of the teacher participants in this study agreed that the course approach, or aspects of it, would be the better type of approach for situated technology professional development. Teachers cited the course approach over self-guided or self-paced because it is what they are used to, is more structured, and more efficient when it comes to time.
What They Are Used To. Traditional professional development is a scheduled class, workshop, seminar, or training held at a particular site with the aim of improving a group of teacher’s general ability to teach or manage a classroom, while all working together. Inside of the training teachers are given specific instructions, asked to follow prescribed steps in sequential order, and told when and where to stop and start. Teacher participants in this study overwhelming expressed that the course approach is what they prefer for their technology professional development. Teachers sited the structure of the course approach as one of the main reasons they prefer it over a self-guided or self-paced model. Teachers are use to the traditional form of professional development and do not give reasons why a different model should be used. However, some participants expressed a desire for some of the aspects of the self-guided model to be combined into the course approach, which are outlined in the next section.

P4 “seems like the more traditional approach for online development [is better] because that's the same approach that we see a lot in our development that we do in the school system. It's more guided, it's more sequential, more directions and directed… And with a more direct course approach I get more out of the information.”

P2 “With a course approach I definitely knew where to go, you hit next, next, next, next… I like the structure of a course approach.”

P4 “I would prefer a course approach and maybe that's just because that's what I'm used to and that's what I'm comfortable with, but definitely to me, I felt like I would get more out of the course approach.”

P4 “I feel like the course approach through Intel is the more traditional approach. That's the one that we've seen more of in our staff development. And for a person such as myself, who really enjoys the directive, the directions of constructed courses, that's the one that I feel I get the most out of.”

P3 “I'm gonna go with the traditional course approach. I guess it's just the teacher in me, I just believe that things work better when there's a certain order. It's concept
upon concept upon concept and just I think that just works better.”

P5 “The course approach, for me, I really like that, because I have a tendency to get frustrated doing a lot of searching and trying to find information. And a lot of times I am not able to locate exactly what I'm looking for.”

**Course Approach and Structure.** Structure was important to teachers in this study who participated in the Intel course approach program. Teachers expressed an appreciation for being told what to do and how proceed in a step-by-step manner. Time was used efficiently because participants did not need to search for guidance; the program did that for them. Participants were also assured that all information and key points were presented and there was no feeling of missing anything.

P1 “I [like] something that's a little bit more structured, like the course approach where it says, 'alright you need to do this first, then when you're done with this you need to do this next.' It makes it a little bit easier for me…”

P2 “With a course approach I definitely knew where to go, you hit next, next, next, next. And they made sure they got all their points across and not just hoping that you were able to wonder into all the points, because that’s where it took you. I like the structure of a course approach.”

**Course Approach and Time.** Participants in this study explained that the course approach helps to plan time better and makes training easier. It was also highlighted in this study that a course approach to professional development made you aware of how much time it would take to complete the course and know what was involved ahead of time.

P5 “But with a course approach you know what the course is going to look like and what it's going to be about. You have the time to sit down and go through the amount of hours that the course is going to be.”

P4 “But its got good information and you get it quick, so as far as time sensitive part, it's very time sensitive.”
Characteristics of the Self-Guided/Paced Approach (Edutopia)

Teacher participants in this study cited aspects of the self-guided/paced approach that were valuable for performing situated technology professional development. The specific parts of the self-guided or self-paced approach that were valuable included inspirational examples and ideas, introduced practical tools, and allowed time for self discovery.

**Inspirational Examples and Ideas.** Participants in Edutopia noted that the program provided lots of resources, including lesson plans, links to other websites and technology tools, video examples, and more. The ability to watch other teachers implementing the ideas and concepts in their classrooms through videos was one of the highlights from participants. They also shared that Edutopia helped to inspire new ideas and avenues for helping students discover the topics covered in the classroom.

P1 “[Edutopia] opened a lot of resources that would be beneficial to [share with] some of our colleagues, after going through this program, and I think that they could, that more of our colleagues could actually use them.”

P4: “The biggest impact with this program was that it gave me some new ideas of things to use in my classroom.”

P6: “I got some really good, new ideas of lessons. They offered a lot of examples, like Storyboard, that I had never heard of. But there were a bunch of different examples and lessons that you could do. I definitely plan to use Storyboard in the future.”

**Practical Tools.** According to the Edutopia participants, the program provided practical tools for classroom use and demonstrated those tools through example lesson plans, how-to articles, and video tutorials. Participants listed technology tools such as the Socrative program, commonsensemedia.com, articles and links to game-based learning resources, examples of strategies and methods for creating student-centered classrooms, and
more. Participants included comments in regards to sharing the resources they found in the program with current colleagues.

P4 “They gave different programs to use, they gave you directions on how to specifically incorporate and use those programs, and then they gave you samples on how those programs operate. They also listed the benefits of these programs. So, they gave you the benefits, they told you how to do it, they gave you examples of how it should look after it's completed. To me that does a great job of modeling how the program should operate, which will help improve the student's ability to use… technology.”

P1 “I skipped over activity number two and went to number three and it wanted us to use the Socrative program, and thankfully I had the iPad cart in here last week and they have it downloaded to our iPads. So, I actually had created a cyber bullying survey and had a media usage survey, that I gave to my students. It was actually quite eye opening.

Allowed Time. Time is another concept emphasized by each of the teacher participants. The participants who went through the Edutopia training appreciated the opportunity to spend as much or as little time as they needed inside of their program. With no facilitator setting the pace, teachers in this program were able to focus on a topic and move on when they were ready. Teachers were also able to deliver strategies and ideas from the course in a timely manner in their classroom. With the option to skip around inside the program, teachers were able to learn about the idea or topic they are currently teaching and use the new ideas and strategies right away in their classroom.

P4 “Well, my entire website is basically self-paced. You go through the different links and you go through the different websites at your pace, which allows you to spend as much time, or as little time needed on each link and each activity, which will definitely work for somebody who has a pretty hectic or pretty busy schedule and has troubles planning for large amounts of time to set that aside.

P1 I really like this more self-paced than anything else…With the Edutopia, the four lessons that it gave us, I was able to kind of skip around, to wherever our curriculum was currently at. And again, for those that didn't fit our grade level, I just kind of skip
over as were not for my students, but I kind of did them in reverse order. Although I looked through all of them in one shot, I kind of started at the bottom and worked my way the opposite way because they are, kind of suited to fit anywhere you need them. They're not something you have to follow in sequential order.”

P6 “The self-guided is more flexible and creative… you can wonder around a bit, and learn a lot about many things… it allows me to access a lot of different information, not as much structure… I really liked it, you could work on your own time, when you want and where you want, you're not pressured. It seemed like less time is wasted.”

P4 “Well, by my program being self-paced, I was able to participate in the program when I was interested and ready to participate. So I was able to focus on it better than let's say it was after school and I was in a hurry to pick up my son from tee-ball practice or something. Whenever I had a couple spare moments I was able to log on to the website and review the information. So I believe I was able to be more focused and pay closer attention to the information they provided.”

P4 “So, non-traditional methods, whether it's through Skype, whether it's self-paced training online, or whether it's just paid professional development during the day, all of those things will go a long way to get that exchange of information that's necessary for the growth of your faculty and staff.”

P3 “I think something more like this that's non traditional and kind of self-paced that you do on your own, structurally like this, it's still structured, but it's not so crunched that people feel under duress. I think that would really be, I think that would be better.”

**Research Question Three**

*What limitations of situated professional development programs should be improved to better meet teacher needs?*

Three categories emerged from the data to inform research question three about limitations to situated professional development: lack of socialization, lack of personalization, and barriers to professional development.
Socialization

The teacher participants in this study reported common ideas in regards to the two programs and socialization. It was noted that both programs had limited communication with other educators and lacked a facilitator for support.

P3 “The only thing that I would say would be a limitation is lack of communication between colleagues. That's probably the only thing. That there was no way that in doing the program that I could connect and talk to other people who are going through the same training or going through the same program and to collaborate and bounce ideas as we were going through the same program. That would have been something I would like to see, sort of collected collaboration.”

Participants were not able to socialize with another teacher or facilitator during their four week program. Participants in both programs felt as though they were handed the entire program, with all of the information and resources, and needed to figure it all out on their own. The teachers felt as though they were not given an opportunity to check their work, or thinking, with others who are going through the program, or have finished in the past.

P4 “I wish there was somebody who was actually working for the website who was kind of moderating a discussion board or something of that nature. Just somebody who I could communicate with when questions arose. Even if it was a question as far as how could I perform this in my classroom with limited technology? Questions of that nature, I wish I had somebody who I could ask.

Personal approach would have been very helpful, you know that human approach would have been cool.”

Intel participants mentioned that there was no facilitator to ask questions about filling out their Action Plan. Though these participants reveal how important that document is to applying what they are learning to their own classroom, there is no facilitator to ask whether there is a better way to synthesize everything to their own classroom, or ask how other teachers have approached similar circumstances.
P5 “…communication with a professional I thought would be a good idea. Some sort of way to get some feedback after you have developed your plan, whether or not you need to make any adjustments in what you have learned before you try it in your classroom.”

**Personalization**

The teacher participants in this study reported common ideas in regards to the two programs and personalization. They noted that their programs could be improved by providing grade level or content area specific tracks, structural improvements such as a table of context, and interface changes such as more or less audio/video.

**Grade Level and Content Area Tracks.** One teacher participant in this study mentioned, and a second agreed, that having grade level and content area specific tracks for participants to choose inside of the programs would be beneficial. This level of choice would allow participants to focus on the aspects of the program that most impact their classroom and specific student demographic. The teacher participant mentioned that the Edutopia already has the resources available to allow tracks, but simply lacked the structure and organization that would allow or guide a teacher through that track. As mentioned in the next section on Structural Improvements, another teacher comments that Edutopia lacks direction and a table of contents.

P1 “I think, maybe having split grade levels, maybe different tracks, one for elementary, one middle, one for high school possibly. And different curriculum areas, although, it does have the resources there for you to go into other areas, like maybe if I was looking for a writing lesson or a writing unit I could go and find it.”

P2 “Intel hit what p1 was just talking about. You chose middle school and it seemed like it very tailored just to middle school.

P1 “the particular program that I walked through was mainly digital citizenship, and I think that putting together other structured programs for different areas would be beneficial too.”
**Structural Improvements.** A limitation that was mentioned by participants in Edutopia was a lack of structure and direction. Participants expressed a concern for the lack of specific steps to take through the program, no clear explanation of where topics ended, and a concern for whether they had missed or accidentally skipped over anything. Suggestions for improvements from participants included creating a table of contents that outlined all sections, readings, and activities. Some sections of Edutopia were short and left participants wondering, “is that it?” Without a structured and step-by-step explanation of where to go and what to read and watch, and then when something appeared to be over the participants were on their own to make sure they completed all readings, viewings, and activities.

P4 “And also my website I wish it would have been more directive. A lot of the information was just stuck there for me to go through it at my own pace, which was great, but I wish I would have had more structure and direction as I went through that information.“

P1 “I think Edutopia… is better suited maybe for a facilitator to actually come and sit and work with a group of teachers, because that’s what it seems like it's made for, but I really do like a lot of the lessons, there's just no real structured development to them… But I do believe it is a great resource for some of the lessons.”

P6 “My program gave me a lot of examples of how to do it, which was helpful. It was interesting, because you had to wonder around, at least the one that I went through, it was not very structured… I wasn't quite sure what I was looking for or what I was suppose to do… It wasn’t really organized, there was no real focus in what I was doing, and I kept telling myself, "Look, I hope I'm doing what I'm suppose to be doing" there wasn't really much to tell you what to do, this is what a lot of student experience when given online work.”

**Interface Changes.** Teacher participants in this study shared their preferences in regards to their programs’ interface and what changes would help make each better. In addition to the structural changes mentioned above in the Structural Improvements
section such as the table of contents, participants commented on the amount of audio in the program. One participant mentioned that there was not enough audio in the Intel program. Through much of the Intel program a narrator was setup as a guide and read through everything on the screen, but there were other sections that this did not happen. The teacher participant mentioned that they could fill out notes, write in the Action Plan, or look over other materials while listening to the audio sections, but could not do all of these things while in the sections where they needed to read and the audio was available.

P2 “I thought Intel was great, I enjoyed it. I would like more audio. They had some parts of the module you had to read and some parts you could listen to and read along at the same time. I kinda liked reading along and listening at the same time. I would say that Intel just needs to do a little bit more audio.”

P1 “…there really wasn't any media. And with it being an online technology-based professional development I think that having more of that technology and media mixed in would make it more beneficial… Edutopia was reading only, did have not have audio, which would have helped.”

**Barriers to Professional Development**

Teacher participants in this study discussed barriers to their technology professional development. This section outlines the topics most emphasized by the participants, including time, resources, and support.

**Time.** All participants in this study mentioned time as a barrier in their classroom and in their professional development. Most often, when time is discussed, teachers express feelings of not having enough of it, or feel pressured to complete tasks in a minimal amount of time. Time is also discussed in terms of activities and life outside of the classroom. Teachers in this study expressed pressure and lack of time while in the classroom attempting to cover curriculum and lesson plans, but many of the teachers in this study complete
professional development outside of their work day in the school building and feel a pressure to complete training while also having a family and participating in other personal activities. Participants in this study mentioned professional development being mandated and how that affects time. Much of the mandated workshops are general information and may not always apply to individual teachers, which takes away from them choosing their own opportunities. Teachers then choose to find and participate in self chosen professional development over the summer when school is out of session and time is open.

P6 “Lack of time, just don't have time.”

P2 “…if you wanted to do staff development then you find it and figure out how to pay for it and how you're gonna get time off to go do it.”

P4 “With time constraints and having a family, having other priorities like graduate work, those are usually the most convenient as far as county wide district opportunities. So those are usually the ones I take.”

P1 “And it's really hard for people, and between coaching and having families, and having other engagements to attend to, it's really difficult when they mandate after school, but then when they mandate it during your planning period you're losing valuable time in school that you could be doing something else. So it's really, it's a delicate balance”

Resources. When discussing resources in the classroom and professional development that supports it, teachers responded that resources are not always available, or support for the hardware is very minimal. Teachers in this study mention Smartboards in their classrooms that sit in the corner without being used because of malfunctions, and technical support has not come to fix them because there are a limited number of them in the county. Teachers also mention their school purchasing items such as carts of iPads, however it is difficult to use them due to being checked out by other teachers. This causes
them to be checked out weeks in advance, which makes it difficult to plan lessons that incorporate iPads when the actual date that students are ready to use them as part of their work may not coincide with the date they are available.

Teachers in this study mention using their own resources in the classroom, such as iPhones, laptops, and iPads, but not all teachers have their own devices to use, and find it difficult to connect with other technology in the school and don’t have support for it because technology support are only permitted to work with county purchased items.

P1 “[We] have lots of technology available to us at school, we have our document cameras, our projectors, smartboards, TVs, iPads, laptops, computer labs, all that kind of stuff. Only problem is some of the technical support and availability of resources is kind of a limiting factor.”

P2 “Well I think one of the challenges that we have at [our school] is trying to have a digital classroom. Some of our technology is tough to get running. You can't always count on thirty of your laptops working in the classroom, you may end up with seven or eight at a time or sometimes thirty, so I think your school's ability to run the technology is a huge part of this.”

**Lack of Support.** Lack of support was something that came across with many of the teacher participants in this study. Most often when discussing lack of support it was in reference to a technical support person to aid with the current technology in the classroom, but it was also the lack of a technology facilitator to help find resources that best help teach content with the available technology.

P1 “I've had a smartboard sitting in my room all year, but, haven't used it once because it is broken and no technical support to come and fix it, so (laugh) I'm not the only one though, there are other teachers that there's has been busted and not fixed either, so maybe we just don't have the parts to fix them or, not sure, but it is just sitting here.”

P3 “I've also noticed the resources they've been giving have been really helpful. When I've wanted more in my classroom it's often difficult to find really good
resources that I could use.”

P1 “…we've got one tech facilitator for a number of schools and she's there one day a week, so he's completely right. Trying to incorporate a lot of the work that the lessons requires definitely can be challenging.”

**Research Question Four**

*What similarities and differences are noted between a course approach and self-guided approach to situated professional development?*

Teacher participants in this study shared the differences between the self-guided/paced and course approaches to situated technology professional development.

**Differences in Course and Self-guided/paced Approach**

According to the teacher participants in this study, the differences in the course approach and self-guided/paced approach to technology professional development included structure, assessment, and choice. The three categories are outlined below.

**Structure.** Participants noted that the structure of Edutopia and Intel were different. Intel was well organized and sequential. Participants knew where to go, what to do, and followed prompts to guide them in the right directions. Edutopia did not have a clear table of contents and was put together as paragraphs with hyperlinks to articles and example lesson plans. It was noted that Edutopia involved more self discovery where participants pieced together their own readings and activities, however, Intel was step-by-step and directed participants through their program.

P1 “…but I'm like P2, I think something that's a little bit more structured, like the course approach where it says, 'alright you need to do this first, then when you're done with this you need to do this next.' It makes it a little bit easier for me to be a little bit more, to have that structure tell me you need to be a little more 'you gotta do this, then you gotta do this' instead of, 'oh, here's the program and you can do it
anyway you want to.' Although I like being able to skip around I also like having some more structure than what Edutopia gave me.”

P5 “The self guided approach you have to do a little more self discovery and do a little bit more research to find what you’re looking for.”

P4 “With the self-guided, I probably spent too much time thinking that I had stuffed and clicking back and forward. And with a more direct course approach I get more out of the information.”

P3 “With the self-guided approach there's too much leeway and people do not get everything, there's a capensity for someone to leave something out. I think that definitely, without any question that the course approach would be much better, much better.”

P4 “And with my approach, with my self-guided website that I went through, like I said most of the information was just included in paragraphs and passages through hyperlinks. So as you read you were suppose to click the hyperlink, or you could choose not to click the hyperlink and continue to move on.”

Assessment. Participants in this study noted the difference in assessment between Edutopia and Intel. Intel provided quizzes to check for understanding throughout each module. It also asked participants to complete an Action Plan to assist in the application of the newly acquired knowledge directly into the participants’ classroom and curriculum. Edutopia did not include assessments in their program and participants were not asked to complete any Action Plan.

P5 “Intel you could choose your own courses, work at your own pace, go through modules step by step, and then they give examples of how to apply it. Each module gives you quizzes to see how well you learned.”

P3 “And I like the little interactive activities [in Intel] where you get to test and see along the way, to check that you got it, 'yeah, I got it, or I missed this, ok.' And, so that's helpful for me, quite helpful for me.”

Choice. According to participants in this study, choice was important to technology professional development training. Much of the professional development
that the teachers in this study mention is mandated and they are not permitted to choose whether to attend or not, choice parts of the training that most impact them, or have the opportunity to choose where and when to take it. Participants in this study noted that the programs gave them choice in what they would like to learn, how they would like to learn the information, and the time and place. Participants in the study were able to choose where and when they wanted to start and stop their program. With both programs being online students accessed them at their most convenient time. Intel participants were able to choose from six different learning modules, while Edutopia participants were given the option of how to navigate the information and what links and resources to choose or to skip over. Participants in both programs also mentioned being under little to no pressure in completing their work due to the fact that no one was watching over them making sure the worked at a particular pace or on a certain segment of the program.

P1 “…overall [the programs are] really great at not only being self-paced and being able to do them on your own timeframe, maybe when you’ve got extra time during planning or maybe on the weekends if you happen to have nothing else to do.”

P3 “I like the fact that it was, that I was able to go on when I was, you know I could go on and, and what I liked about it is that it was just so easy to pick up where I left off. You know, am I going to be able to get to this part of the module today or the next couple of days or whatever? I could pick up where I left off at any instance and it really fit together like a glove.”

P2 “I think, like P1 was saying, that you definitely need the choice… I think being able to work on it on your own pace is definitely the way to go.”

P2 “Intel shows four different levels of inquiry, guided and it almost steps you in to the process rather than throwing you in to the process, it’s not an immersion model. And it’s kinda nice, it lets you choose what you think your students are ready for and what you’re ready for, rather than having to go full boar.”
Summary

The major findings and detailed analysis of the findings have been outlined in this chapter. Research question one focused on teacher experiences with Intel Teach to the Future and Edutopia Technology Professional Development Guide in helping participants in this study learn to integrate technology consistent with National Educational Technology Standards for Teachers (NETS-T). Analysis of focus group and individual interviews revealed that each of the five NETS-T standards were covered. Participants also noted that the programs were presented in a 21st century learning format, which made them relevant, inspirational and helped participants create personalized materials for their classroom.

Research question two asked what characteristics of selected situated Professional Development programs help teachers meet their need for self-directed, in-context, time-sensitive training? Teacher participants from this study noted that the course approach to technology professional development was better than the self-paced/guided approach. Participants cited that the course approach is what they preferred because it is what they are use to, has a structure that is better tailored for how they want to learn, and is better in terms of time. Aspects of the self-guided/paced approach were highlighted by participants as beneficial. These included inspirational examples and ideas that made teachers want to do better in their classroom, practical tools and how-to guides for implementing what they were learning into their own curriculum, and time to explore topics inside the program that interested them.

Research question three centered on what limitations of situated professional development programs should be improved to better meet teacher needs. Teachers sited
socialization, personalization, and barriers to professional development as the main limitations of the two programs used in this study. In terms of socialization, the participants could not communicate with a program facilitator or colleagues. For personalization, the programs could provide grade level and content area tracks, improve structural organization of Edutopia by including step-by-step instructions, and also improve the interface by creating a table of contents. Barriers to professional development included time, resources, and lack of support. In regards to time, teachers express feelings of not having enough of it, or feel pressured to complete tasks in a minimal amount of time. In terms of resources, teachers responded that resources are not always available, or support for the hardware is very minimal.

Research question four focused on the differences that were noted between a course approach and self-guided approach to situated professional development. Participants shared the differences between Intel and Edutopia. These included the structure of the programs, assessment, and choice. The structure of Intel was well organized and sequential and Edutopia was not. Intel included an Action Plan inside of the program where participants targeted their learning into action steps to implement what they were learning into their classroom and curriculum. Edutopia did not include an assessment for participants. Choice was also a difference in the two programs. Intel participants were permitted to choose what modules to participate in, while Edutopia allowed for teachers to choose how they navigated through program. Edutopia was not structured in a manner that guided participants through the program, rather they were permitted to proceed in whatever manner they chose. Overall, participants in this study responded positively to their programs and brainstormed ideas for,
how to make each better during the focus groups at the conclusion of the study. A detailed discussion of the major findings are presented in Chapter Five, Discussion.
CHAPTER FIVE: DISCUSSION

The aim of this qualitative case study was to examine teacher situated technology professional development in the middle school science setting. Six middle school science teachers participated in this study and utilized two free online technology professional development programs, Intel Teach to the Future Teach Elements and Edutopia Technology Integration Professional Development Guide.

The study was guided by four research questions:

1. What are teachers’ experiences with situated technology professional development programs that help them learn to integrate technology consistent with National Educational Technology Standards for Teachers (NETS-T)?

2. What characteristics of selected situated professional development programs help teachers meet their need for self-directed, in-context, time-sensitive training?

3. What limitations of situated professional development programs should be improved to better meet teacher needs?

4. What similarities and differences are noted between a course approach and self-guided approach to situated professional development?

Major findings from this study included participants agreeing that both programs did well in addressing each of the NETS-T Standards. Participants felt the programs were relevant, engaging, and helped in creating personalized materials that fit their curriculum and classroom (Intel- Action Pan). Participants in this study also felt, overall, that the course approach is the better approach to situated technology professional development because it was what they were use to, they appreciated being told what to do in a step-by-step manner,
and it allowed them to plan time better because they knew what to expect and how long.

Participants in this study also noted aspects of the self-guided/paced approach that were valuable, including: providing inspirational models, ideas, and examples through video and example lessons, introduced practical tools, and allowed time for self discovery.

Programs utilized in this study could be improved through increased socialization with communication between other colleagues and a facilitator for support. The programs in this study could also be improved through personalization by adding grade-level/content specific tracks (Edutopia), table of Contents/Direction (Edutopia), and more audio in order to listen while working on Action Plan or other activities (Intel).

Differences between the two programs included the structure and assessments. Participants noted that Intel was organized and sequential and also provided quizzes and an Action Plan.

Similarities between the two programs included choice. Participants were able to chose what they wanted to learn and how they would like to learn, and also the time and place where they accessed the programs.

This chapter presents discussion on the major findings and detailed analysis from the research questions. The discussion is separated into six major themed sections that developed during analysis of the participant data and relate to existing professional development literature. The sections include: promoting socialization, enhancing personalization, blending the course and self-paced approaches to technology professional development, building on criteria for optimal technology professional development, avoiding barriers to professional development, and the technology abundance paradox, with a summary at the end of the chapter.
Promoting Socialization

Analysis of participant interviews from this study suggests that socialization is a major factor in the success of technology professional development. Participants repeatedly mentioned that having an instructor and fellow teacher participants in the program with them would have enhanced their experience and deepened their understanding of the concepts and ideas covered. Participants also mentioned the desire to share resources with colleagues who might benefit from their use.

Interacting with Fellow Participants

Teachers in this study desired more opportunities to socialize with other course participants and an instructor to enhance their learning experience. Participants expressed feelings of being alone and uncertain when it came to completing their Action Plans or generating their own ideas from what was being covered in their training. Intel participants had the opportunity to write down ideas of how to incorporate concepts into their own classrooms and curriculum, however having the opportunity to ask fellow participants how they are planning to incorporate the ideas might spawn new, and better ideas when participants have the chance to share with one another. In a time when technology is abundant, teachers should be able to leverage it to connect with one another to share these best practice scenarios. Web 2.0 tools and services should play a big part in teachers connecting with one another and learning from each other. Riccio (2010) found that science teachers who participated in an online Community of Practice (COP) with other educators across the United States, viewed the experience as an effective way to perform technology professional development. Teachers believed that the live interactive learning
environment was critical in understanding new concepts, and the flexibility of the courses all indicated that teachers had positive attitudes toward the experience. Social networks, such as the one utilized in the Riccio (2010) study, allow teachers to find targeted groups that can share specific content that relates to a teachers classroom dynamics and curriculum, however teachers will need to be introduced to these tools and trained to use them in order to be able to connect on a level that will allow their practice to be impacted. Both Intel and Edutopia should incorporate COP to enhance the participants’ experiences.

Teachers inside of this study are not alone in their desire to connect with other educators to create online communities around specific topics, ideas, tools, and/or strategies. Websites and online training such as Teacher Tech Training (T3) (http://www.teacher-tech-training.com) have been created to assist teachers. T3 is a website with the goal of giving teachers the resources they need to use technology with their students. The T3 online course grew out of a workshop for elementary school teachers into a community-building site that allows for participants to engage with other teachers as they learn more about technology tools available to educators.

Online communities and training opportunities such as T3 should be shared with all educators, particularly since school funding and development of technology have made it possible for nearly 100% of public schools to have Internet access (Greenhow, Robelia, & Hughes, 2009, Ertmer, Ottenbreit-Leftwich, Sadik, Sendurur & Sendurur, 2012) and the wide availability of Web 2.0 tools has made access to powerful communication and collaboration tools almost a ‘non-issue’ for any teacher who has Internet access (Ertmer et al, 2012, p. 424).
Sharing Resources

Participants in this study shared a sense of inspiration to do more in their classrooms, due in large part to the resources that were provided in their programs. Participants expressed a motivation to share many of the resources they used, and created in their programs, with colleagues. The work of Costa (2009) would support the motivation of teachers wanting to share resources with colleagues online. In her article she outlines the idea that Web 2.0 Learning Environments liberate teachers in learning themselves and then sharing their work with others. Research from Marrero, Woodruff, Schuster and Riccio (2010) also support the idea of sharing resources online when examining a series of professional development short courses with science teachers. In particular, teachers in their study found a community of practice where sharing resources with other educators and instructors from across the United States was beneficial. Programs such as the two outlined in this study provide opportunities for teachers to do both, update and acquire new skills and resources to share with one another.

Enhancing Personalization

Participants in this study cited the ability to personalize their program as one of the strengths of their experience. Teachers were given the ability to skip around inside one program (Edutopia), choose modules in another (Intel), start and stop when desired, and complete a personalized Action Plan (Intel). Participants suggested several added features for each program to maximize personalization: providing tracks for different grade levels and content areas, outlining paths in support of choice, providing varied media in support of choice, and supporting the application of content to personal teaching situations.
Providing Tracks for Different Grade Levels and Content Areas

Participants from this study agreed that their program could be improved if there were grade level and/or content specific tracks. This would have given teachers opportunities to choose the aspects of their program that most impacted their classrooms and specific audience of students. Intel participants were given the option to choose between six different learning modules, however they could not move around inside of the module. Edutopia allowed participants to move around inside of the training, however did not provide a choice of different modules, or learning tracks, to give more variety in the topics covered. Participants in this study highlighted that a combination of all of these characteristics has the potential for creating a maximized professional development experience.

Outlining Content Paths in Support of Choice

Participants from Edutopia identified a lack of specific steps to take through the program, no clear explanation of where topics ended, and a concern for whether they had missed or accidentally skipped over anything by mistake. Adding a table of contents that outlines all parts of the program that teachers should complete would be beneficial. An organized chart would allow participants to see recommended paths through the content and not miss important information. Edutopia participants expressed that not having a fully complete table of contents was problematic because it allowed skipping around, and they would prefer having more guidance.

Providing Varied Media in Support of Time

Teachers from this study shared ideas for improving the experience of both programs.
Participants believe that more audio in Intel and more media in Edutopia would better deliver content to teachers looking to maximize their time and knowledge acquisition. Participants in Intel mentioned that audio was not available in all sections of the program. One teacher specifically spoke of listening to the audio while completing other tasks simultaneously, such as taking notes, filling out the Action Plan, or completing other classroom responsibilities while listening. This was a valuable use of teachers’ time and allowed them to get more work done inside the program while listening to audio compared to sections where the audio was not available.

In regards to adding more media to Edutopia, one teacher noted that the program is an online technology-based professional development training, so having a rich media experience would make sense. Video and multimedia are known for delivering a lot of information in a time-limited form. Videos often combine visual, audio, and text information into one, and have the potential to be the best option for teachers seeking professional development in a time-constrained environment. Video can also be easily delivered via the Internet through a host of Web 2.0 applications, such as YouTube, which is a tool that participants in this study mention using in their teaching. The two trainings utilized in this study, and other training in general, should consider adding more videos to take advantage of presenting information inside of the teachers’ time constraints. As Zhang, Zhou, Briggs, and Nunamakerjr (2006) point out, utilizing video as an instructional tool in online learning provides time and location flexibility, fosters self-directed and self-paced learning, and allows information to be updated in an efficient way.
Supporting the Application of Content to Personal Teaching Situations

Intel required participants to complete an Action Plan during their training. This document allows teachers to put practical steps into place in order to incorporate the ideas and tools outlined in the Intel training into teacher classrooms. At the conclusion of the study Intel participants from this study believed that the Action Plan was a crucial part of the Intel training. The study from Harris (2005) would agree, stating that an important aspect of Intel is its focus on the teacher participant’s own classroom, and specifically, the Action Plan helps to define and re-create parts of the training experience so that it will, “meet their local needs and make the core concepts immediately useful and relevant to their classroom teaching” (p. 3). Results from the present study and Harris (2005), make the case that more technology professional development should include an Action Plan or, at minimum, an opportunity for teacher participants to plan specific steps for incorporating ideas, tools, and strategies into a teacher’s own classroom and curriculum. Edutopia did not require an Action Plan. One Edutopia participant mentioned adding something similar to an Action Plan to Edutopia to help guide the technology integration process into their classroom.

Blending the Course and Self-paced Approaches to Technology Professional Development

Based on the feedback from teachers in this study, blending the course (Intel) and self-paced (Edutopia) approaches to technology professional development may serve as the best model for delivering situated training that is self-directed, in-context, and time-sensitive. From the course approach, participants appreciated the structure and personalizable Action
Plan. From the self-paced approach, participants appreciated the flexibility of choosing topics and the time for self-discovery.

Course Approach (Intel)

Teachers in this study shared that the course approach from Intel was the preferred way to participate in technology professional development. Participants found that the course approach was what they are used to, provided the preferred structure, and was the most effective and efficient in regards to their time. Holmes, Polhemus and Jennings, (2005) agree that “Effectiveness, efficiency, and sustainability” (p. 384) are key issues that keep teachers in professional development programs. Participants from this study believe the structure of Intel provides what they need in terms of time-sensitive training.

When participants mentioned training that they are used to, they shared that the course approach is more guided, has a specified order, and gives specific directions. Polly (2006) found positive results from a course approach on technology integration where participants came away with more knowledge on how to use technology and how to incorporate it into lessons. However, participants from that study were exposed to a forty-five hour face-to-face course that involved teachers learning from instructors who modeled integration, worked with partners to investigate strategies, and designed classroom lessons that incorporated technology. Participants in the present study discussed combining elements of Intel (course approach) with Edutopia (self-guided/paced approach) to maximize the experience.

Participants from this study shared that they want to be told what to do inside of the program, have step-by-step instructions, and know that all key points and information are
presented to them by the end of their experience. Participants appreciated being told where to go, what to click on, and when they were permitted to move due to mastering a topic. Teachers should not leave a session, workshop, or module wondering if they met all requirements or viewed all of the necessary points from a training. Edutopia was set up differently than Intel, participants could go wherever they wanted without being told, were not told to stop, or held up to master a concept before moving on. Participants had the option of clicking on everything in a section, or not clicking at all. Participants preferred the Intel setup of being told what to do, but shared that having the option to move around inside of an Intel module would be better, so that they could pick and choose topics that most resonate, or are needed right away due to teaching the content at the time of learning and could incorporate it into lessons right away.

**Self-guided/paced Approach (Edutopia)**

Teachers in this study shared aspects of the self-guided/paced approach (Edutopia) that were positive in performing technology professional development. Participants found that the self-guided/paced approach allowed time for self-discovery of inspirational examples, ideas, and practical tools to use in their classrooms. When discussing inspirational examples and ideas, participants cited lesson plans, links to other websites and technology tools, video examples, and more. The purpose behind Edutopia’s Technology Integration Guide is assisting teachers in better understanding technology integration and project-based learning, and offering free teaching modules developed by teachers to extend existing lessons with articles, video footage, PowerPoint presentations, and class activities that pull from the website’s archives of best practices (Annan, 2004).
Participants mentioned that Edutopia (self-guided/paced approach) provided practical tools for classroom use and demonstrated those tools through example lesson plans, how-to articles, and video tutorials. Participants listed technology tools such as the Socrative program, commonsensemedia.com, articles and links to game-based learning resources, examples of strategies and methods for creating student-centered classrooms, and more as helpful to their teaching. They also expressed an interest in sharing these resources with colleagues who would benefit from the valuable ideas.

The participants who went through the Edutopia training appreciated the opportunity to spend as much or as little time as they needed inside of their program. With no facilitator setting the pace, teachers in this study were able to focus on a topic and move on when they were ready. Teachers were also able to deliver strategies and ideas from the course in a timely manner in their classroom. With the option to skip around inside the program, teachers were able to learn about the idea or topic they are currently teaching and use the new ideas and strategies right away in their classroom.

**Differences in Course and Self-guided/paced Approach**

Developers of technology professional development should consider blending elements of the course and self-guided/paced approaches. Teacher participants appreciated the sequential and well organized nature of the course approach, which included a table of contents, easy to follow step-by-step instructions within the program to help participants navigate, and clear instructions of when sections and modules were complete. Teachers in the self-guided approach pointed out the more open, discovery aspects of the program allowed them to begin learning topics that were most relevant to them, in their classrooms, at the
moment they were participating. Participants appreciated being able to choose where to start and how to complete all of the components of the training. One teacher revealed that they started at the end of the program and worked their way toward the beginning, which helped because they were able to learn what they were most interested in, first.

Combining the differences in course and self-guided approaches to technology professional development could result in a hybrid that helps a greater number of teacher participants. A program with a table of contents, easy and step-by-step navigation, that allows participants to choose what sections or modules to complete may be what is most desired, particularly by teachers similar to those who participated in this study. In the place of a linear program with a beginning and end where participants are done when all parts have been completed in order, participants may complete all modules in the order that they choose.

**Avoiding Barriers to Professional Development**

A major finding from this study is that barriers to technology professional development exist. Teachers from this study experience barriers in the lack of time, resources, support, and motivation.

**Time**

Time was a barrier for all participants in this study. When discussing time, most often teachers expressed that they did not have enough, felt pressured to complete all of their work in a minimal amount of time, and have other responsibilities outside of the classroom that effect their time. Dede, Ketelhut and Whitehouse (2009) document the frustrations teachers have with increased job responsibilities, leaving less time for professional development.
Dede, Ketelhut, and Whitehouse emphasized that a, “real-time, ongoing, work-embedded” professional development program that would, “make certain that time, effort, and scarce resources are expended on quality programs that teach with and about best practices” could help to alleviate some of the frustrations teachers have (pp. 8-9).

Resources

Resources were also mentioned as a barrier to professional development and specifically the unavailability of existing school technology resources and lack of support for hardware. Hew and Brush (2007) have provided evidence of teachers not using technology because of their feelings and frustrations over the difficulties in implementing technology in a school that does not provide adequate time and resources. If teachers are expected to use the technology they are provided to increase student achievement, support for the hardware will need to be in place behind resource availability.

Human Support

Lack of support mentioned by participants was in reference to hardware malfunctions, but also to the lack of technology facilitators to assist in matching technology equipment and tools with pedagogy and assessment goals. Research from Keengwe (2007) supports the notion that teachers are not making the connection between technology integration training and their classroom curriculum because they are not trained to use the technology tools given to them. A large part of this problem is that there are not enough technology facilitators to help teachers integrate technology into their existing classrooms and curriculum. Although statistics show improvements in access to Internet and computer technology in schools,
teacher data shows a decline in the use and integration of these same technologies (Wachira & Keengwe, 2010). Teachers are frustrated with the mandates of using technology and then being on their own to figure out how it fits in to what they are already doing. In order to maximize the effects that the available technologies can provide for student achievement in classrooms, technology facilitator positions must coincide with the deployment of computers. As Sugar (2005) has discussed, technology facilitators should work closely with teachers, administrators, students, and support personnel when technology is used in schools. As he goes on to point out, “an overwhelming number of teachers benefit from a technology [facilitator]” (p. 548).

Motivation

There is a lack of motivation on the part of some teachers to use technology (Keengwe & Onchawari, 2009), and therefore to attend professional development on the use of technology (Abumaid, 2011). In total, several hundred teachers were notified of the two free technology professional development programs utilized in this study and only twelve agreed to initially participate. Out of the twelve, six participants finished the study. Despite the programs having free access, and the researcher offering CEU credit and a $25 gift card, only six teachers ended up participating. The lack of motivation to participate in this study can only be speculated on, but the barriers mentioned above, such as time, resources, and support provide good possibilities.

The six teachers who participated in this study are self-identified as being technology proficient and confident in their ability to utilize technology in their classrooms and inside lessons. However, what about the teachers who didn't participate, where are they getting
training? If trends continue and technology is provided to classrooms where teachers do not have training, what does that mean for students who sit in those classrooms?

The Technology Abundance Paradox

As outlined in the Introduction to this study, government spending on, and access to, technology resources in education is increasing (National Center for Education Statistics, 2006). Spending on information technology (IT) in the United States was expected to reach more than $56 billion in 2012 (Nagel, 2008). Schools and classrooms, including those mentioned in this study, find themselves with laptop carts, classroom stations of computers, computer labs, sets of iPads or other tablets, iPod touch bundles, SmartBoards, document cameras, wireless Internet resources, and nearly unlimited Web 2.0 and 3.0 tools. Schools continue to raise and receive funds to purchase more of what they already have because the items are often checked out weeks in advance. Districts are also pushing for 1:1 models where every student and teacher has a device, and through the bring-your-own device movement leveraging student-owned equipment, 1:1 schools will soon become the norm rather than the exception. The introduction of mobile learning strategies will only fuel the drive for more technology. There is an abundance of technology in education on a level never before seen.

Although there is an abundance of technology in schools and classrooms, the paradox is teachers are not trained to use the hardware and software that is pushed or mandated of them, nor are their superiors who are pushing for its use. As outlined in this study’s results and review of the literature, teachers are not receiving adequate professional development in general, and specifically not with the technology tools and strategies that are pushed for or
mandated by school administration and district officials (Henessey, 2005; Hew & Brush, 2007; Keengwe & Onchwari, 2009). Teachers are also not receiving facilitation support for the technology that is in their schools and classrooms. Stranack (2012) reports that professional development is often the first item to be cut from budgets during a time of restraint. This often includes cutting positions such as technology facilitators from schools. With fewer personnel to aid in the integration of new technology, the responsibility falls back on the classroom teacher to find, or figure out, how to incorporate technology into their existing lesson plans. With little time to find their own professional development training that is not inadequate and targets the specific curriculum being taught, teachers will either have to travel and/or spend funds for expensive trainings that are not offered online and are not free. Organizations and higher education institutions who can afford to offset costs to teachers by offering free or low cost trainings are either not targeted at specific teachers or are designed for localized teacher groups close to the university.

So the question is, what do teachers do when they are mandated to use the technology they are given, given little or insufficient training to use it, and do not have the support of a technology facilitator or hardware technician to maintain the equipment or find strategies for using it within their lessons? The question has few research-based or practical answers, and forms a paradox: there is an abundance of technology, but not enough training and support to hold it up. As work from Sugar (2005) points out, a technology coach/facilitator, “may be a remedy for those teachers who are initially reluctant and skeptical to adopt new technologies in their classroom” (p. 566). Without adequate training and support as pillars, the weight and benefit of new technologies cannot be up held.
To further complicate the matter, there can also be an abundance of professional development. Teachers may participate in many mandated trainings that are provided by their school or district, however what participants in this study pointed out was that they wanted something very specific and focused. Participants alluded to content and grade level specific training that matched the subject, or subjects, they teach and their grade level. Instead of having an entire school or district in one room completing the same generalized training, teachers could see greater benefits if their training matched what they were teaching in their classrooms and for the age of their students. If too much training is present, but not in the mode that best supports the teacher, it can cause in imbalance in the use and benefits of having technology in the classroom. Figure 2 below illustrates a possible abundance of training imbalance.

Figure 2: Technology Abundance Training Imbalance

The ideal scenario is that teachers are exposed to technology tools and strategies specific to their content area and classroom curriculum, are given the choice of tools and strategies that will deliver their content to students in the manner in which students receive
the maximum impact, and are trained and supported equally to remain effective over the long term. For most classrooms this is not the case and teachers are forced to use tools that may not fit their lessons just for the sake of having used technology to report that students are using it.

What is most often missing in schools is the opinion of the person who is paid to be the expert in teaching and learning in the classroom--the teacher. Students impact even less of the decision-making in regards to what technology is used in classrooms. However, the benefit of their input is beyond the scope of this study.

Conclusions

Participants in this study believed that both Intel Teach to the Future and Edutopia Technology Integration Professional Development Guide were effective at helping teachers to learn to integrate technology consistent with National Educational Technology Standards for Teachers (NETS-T). Participants believed that the programs help teachers meet their need for in-context, time-sensitive training. Overall participants found the course approach to professional development, such as with the Intel program, to be the preferred method of training delivery. However, specific aspects of a self-guided approach, such as Edutopia, could be combined to create an optimal experience. Participants from this study site the ability to choose what sections to work through as one of the main advantages of a self-guided approach, as opposed to a linear start to finish model where participants are forced to start at one and stop at ten. Socialization and personalization are two major areas in which Intel and Edutopia can improve to deliver a better experience for participants. When
discussing socialization, participants specifically point to interaction with fellow participants and an instructor as valuable pieces that should be included in both of these programs.

In reference to personalization, providing tracks for different grade levels and content areas was recommended, in addition to outlining content paths in support of choice, providing varied media in support of choice, and supporting the application of content to personal teaching situations. This study makes the case for combining all of these components to create a blended course/self-guided approach to technology professional development for the best participant experience. A list of the criteria for optimal technology professional development was created as a possible checklist for current and future trainings and can be seen in the section below.

This study outlined many barriers to technology professional development training, including lack of time, availability of resources, support, and motivation. In regards to time, designers of professional development programs should consider creating opportunities where participants choose how to navigate within the program. This would allow participants to participate in the sections that matter most to their classrooms, curriculum, and students at the moment they are in the training. Designers should also consider more audio and video. Teachers can consume more information in a shorter amount of time using videos and can also be working on more than one thing while listening to audio, such as the participant in this study who worked on the Action Plan while listening to recorded audio of the Intel program.

Availability of resources differs with each teacher and each school. Professional development designers should take this difference into consideration and provide
opportunities within trainings for participants to choose whether they are a 1:1 school, a one computer lab classroom where there are six computers for twenty-four students, or less than this. Allowing for choice in which situation most resembles what the participant has available would allow for the most impactful training program.

Not all teachers have the support of a technology facilitator, or their administration in the technology professional development training that they participate in. Creating Action Plans, such as with the Intel program, may help participants plan to use what they are learning in their own classrooms and with their own curriculum. Participants in this study involved in the Intel program spoke of the vitalness of the Action Plan in preparing to incorporate what they learned into their own practice. All professional development programs should consider this type of component to their program.

Motivation to complete technology professional development is noted in this study. Many factors are involved in teachers’ motivations to participate, or not, in training, including time, availability of funds, and compensation. Teachers cite not having time to complete training due to other job responsibilities, location and time of day of the training (after school), and life outside of the classroom. Teachers will often look for free trainings because their school or district cannot afford to send them to trainings, especially during difficult economic times. Also, teachers are not always compensated for training. This could be a monetary form, time exchange where they can exchange time in training for later time off, or other gifts such as equipment for the classroom or personal gift cards.

Despite barriers of time, resources, human support, and motivation, teachers in this study were able to self-perform professional development using situated approaches, thus these approaches warrant consideration and further study.
This study notes there is a Technology Abundance Paradox, or challenges that teachers face in trying to use the plentiful technology that is available to them. Although technology is abundant in many American classrooms, including those outlined in this study, teachers are often stuck with technology that they do not ask for, little to no training on how to use it, and fleeting support for integrating it into their classroom and curriculum. Professional development programs are not difficult to find, however teachers need choices that situated models can provide. They need the opportunity to choose what technology training will most impact their classroom, curriculum, and students. They also need training that fits how they work and learn and can take place anywhere and anytime, and takes advantage of the technology tools that can deliver in context, time-sensitive training with options to stop and start as needed.

Additional research in the area of this study could include sitting with participants as they go through the programs and prompting them to discuss their experience. This could include asking what they liked and prodding to make sure they are specific. This would reveal richer data.

Criteria for Optimal Technology Professional Development

Based on the findings from this study, a list of Criteria for Optimal Technology Professional Development has been compiled. The characteristics, limitations, and anecdotal evidence of best practices has been synthesized into the following list, presented in Table 6 below.
Table 6: Advanced Organizer for Key Findings

<table>
<thead>
<tr>
<th>Criteria for Optimal Technology</th>
<th>Professional Development</th>
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<tbody>
<tr>
<td>Guidance:</td>
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<tr>
<td>Participants are informed about what the program includes and what components they should complete through a Table of contents</td>
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<td>Step-by-step instructions through the entire program such as next /back/home buttons</td>
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<td>Participants are able to track which portions of the program have been completed, so they do not miss important information</td>
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<td>Personalization and Choice:</td>
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<tr>
<td>Opportunities to create personalized technology materials, including an Action Plan or, at minimum, an opportunity to plan specific steps for incorporating ideas, tools, and strategies into a teachers’ own classroom and curriculum</td>
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<td>Ability to participate when the timing is best, and the place is most convenient, for participants, including outside of the school</td>
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<tr>
<td>Using audio and video and example lessons and resources to engage participation, and links to articles from teachers who used the lesson plans</td>
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<td>Socialization:</td>
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<td>Utilizing a network of colleagues to work out ideas and share content</td>
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<td>Having a program facilitator available to ask questions</td>
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<td>Time:</td>
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<td>Ability to start and stop when the participant desires</td>
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<td>Ability to come back to the place left off at a more convenient time</td>
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This list may serve as a checklist for current programs to consider when redesigning their training or for new programs to use in the creation process.
References


APPENDICES
APPENDIX A
Semi-structured Interview Protocol

How would you describe your knowledge of integrating technology into the classroom?

Describe any impact the program has had on you.

In what ways are students in your classroom being advanced in their learning, creativity, and innovation in both face-to-face and virtual environments? (NETS-T Standard #1)

How are your students experiencing digital age learning and assessments? (NETS-T Standard #2)

What are the ways that digital age work and learning are being modeled for your students? (NETS-T Standard #3)

How are your students learning about digital citizenship and responsibility? (ISTE NETS-T Standard #4)

In what ways do you engage in professional growth and leadership? (ISTE NETS-T Standard #5)

Has the training model met your need for self-directed professional development training? Training in the context of your classroom? Time-sensitive? If not, how would you improve it?

Is there anything else you would like to add?
APPENDIX B
Semi-structured Focus Group Interview Protocol

RQ 1: What are teacher’s experiences with situated technology Professional Development programs that help them learn to integrate technology consistent with National Educational Technology Standards for Teachers (NETS-T)?

Before you started the [Intel/Edutopia] training, how would you describe your knowledge of integrating technology in the classroom?

Describe any impact the program has had on you.

How well is the [Intel/Edutopia] program helping you learn about these NETS-T standards (hand teachers the two-page PDF from ISTE and ask them to respond to each of five standards):
   a) facilitate and inspire student learning and creativity
   b) design and develop digital age learning experiences and assessments
   c) model digital age work and learning
   d) promote and model digital citizenship
   e) engage in professional growth and leadership

RQ2: What characteristics of selected situated Professional Development programs help teachers meet their need for self-directed, in-context, time-sensitive training?

What problems do you see with traditional professional development such as after-school workshops and professional learning teams?

How does the structure of the [Intel/Edutopia] program address some of these problems?

RQ3: What limitations of situated Professional Development programs should be improved to better meet teacher needs?

What changes would you recommend to the structure of the [Intel/Edutopia] program to better address the need for professional development that teachers can take on their own time and integrate into their own curriculum?

RQ4: What similarities and differences are noted between a course approach and self-guided approach to situated professional development?

Focus Group Only: Overview the core differences between the two programs to both teachers (Intel course approach versus Edutopia self-guided approach). Ask teachers:
   a) Which format do you think works better and why?
   b) Are key elements missing from either program to help teachers self-perform professional development?
Intel® Teach Elements
Inquiry in the Science Classroom
Action Plan Summary Form

Date:
Name:

Based on responses in your Action Plan, complete and submit this short form as a summary of your planning.

**Module 1** (Action Plan Lesson 2, Activity 2; Lesson 2, Activity 3)

1. List ideas that you have for adding scientific inquiry to a particular lab or activity that you already teach.

2. List recent inquiry-based investigations in your classroom and identify where each is on the continuum (Open, Guided, Structured, Limited).

3. How does the continuum help you consider opportunities to build more inquiry into the curriculum?

**Module 2** (Action Plan Lesson 1, Activity 2; Lesson 2, Activity 3)

1. What specific habits of mind and inquiry-based abilities do you want your students to first learn to help them be successful with scientific inquiry?

2. Which skills will you focus on to help your students be successful in scientific inquiry? Identify skills and note which activities or units will emphasize these skills.
   - Measuring
   - Observing
   - Estimating
   - Predicting
   - Classifying
   - Interpreting
   - Inferring
Communicating
Asking inquiry questions
Creating a hypothesis
Designing procedures
Designing methods for documenting data
Information literacy

Module 3 (Action Plan Lesson 2, Activity 2; Lesson 3, Activity 3)

1. What areas in your curriculum would be appropriate for a scientific inquiry project?
   - What level of inquiry will your students participate in?
   - What kind of investigation would students conduct?
   - How might you introduce the project?

2. Identify any assessments that you have saved for use in your classroom. Describe how you will use these assessments.

Module 4 (Lesson 2, Activity 3; Lesson 3, Activity 2)

1. What goals can you set to make your classroom more of a learning community?

2. What collaborative activities will you design for your students?

3. How could you help your students be more self-directed?

4. Describe ways you can include more scientific discourse in your classroom. How can you add or modify speaking and writing activities to support scientific inquiry practices?

Module 5 (Lesson 2, Activity 2; Lesson 3, Activity 1)

1. What online data interpretation tools would you like to investigate for your students to use?
2. Consider the types of data your students will collect for their inquiry investigations. Which technology tools might be the most useful and relevant for your students to present their data?
APPENDIX D
Teacher Log Template

Teacher Log

**Instructions:** Please use this log to record any general thoughts, personal anecdotes, challenges, frustrations, or statements of achievement, as you work through the assigned professional development program.

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APPENDIX E
List of Codes

Axial Codes
Addressed the standards
Barriers
Course approach
Depends on the teacher
District professional development
Edutopia has been very helpful
Edutopia improvements
Find my own professional development online
Intel Action plan good idea
Intel has been very helpful
Intel Improvements
Interesting quote
Not tech savvy
Self-guided/paced approach
Technology challenges
Technology is valuable types of technology used

Themed Codes
addressed the standards (RQ1)
tech savvy/general 21st century skills (RQ2)
    engaging
    inspirational models
    creating personalized materials
characteristics of self-guided/self-paced approach (RQ2 & RQ3)
    socialization
    personalization
        grade level tracks
        structural improvements
        interface changes
    barriers
    time
    resources
    lack of support
Improvements (RQ4)
    structure
    assessment
    choice