

USING TECHNOLOGY IN GIFTED AND TALENTED EDUCATION CLASSROOMS:
THE TEACHERS' PERSPECTIVE

by

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ABSTRACT

New technologies emerge frequently. Administrators and teachers have to decide which technologies are worthwhile investments of both limited funds and instructional time. Standards from the Partnership for 21st Century Skills and the International Society for Technology in Education encourage educators to teach skills that will help students adapt in the changing working environment of the future. These skills resemble the National Association for Gifted Children's program and teacher preparation standards. Qualitative research was conducted to determine if teachers of the gifted and talented use technology to provide differentiated instruction and to promote student learning of 21st century skills. A multi-case phenomenological study examined how teachers of the gifted and talented use and shape technology experiences with students, and the extent to which they differentiate technology lessons with respect to autonomy, complexity, instruction in technology, and ability level.

DEDICATION

This dissertation is dedicated to my family: to my loving husband Jim, and in particular to my three children Doug, Andy, and Josie. It has been a journey of discovery for all of us.

It is also dedicated to the memory of Dr. Catharine de Wet. You were more than just a professor, you were a friend.

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“Do not confine your children to your own learning, for they were born in another time.”

-Chinese Proverb

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CHAPTER 1

INTRODUCTION

Context

In an era in which much of the emphasis in public schooling has been placed on the remediation of students, it is difficult to know whether the curriculum in elementary classrooms is asking children who have high academic ability to use their knowledge and skills or to develop their full potential. Although teachers want to meet the needs of all their students, the repercussions for failing to make adequate yearly progress ensures that their focus is on struggling students (Loveless, Farkas, & Duffett, 2008; National Association for Gifted Children & Council of State Directors of Programs for the Gifted, 2009). Many teachers simply hope that the resources available will provide an adequate education for the other students.

Among the most readily available resources a teacher has in the classroom today is technology. The amount and use of technology may vary from school to school and even from classroom to classroom, as may the extent to which it is up to date. However, more and more teachers are relying on the use of computers, both to support lesson planning and administrative duties, as well as for instruction (Bebell, Russell, & O'Dwyer, 2004). Some teachers actively utilize technology with students, which can impact both what is being taught and how it is taught (Koehler & Mishra, 2005). Some classrooms have desktop computers, some have laptops, and some teachers on the cutting edge of education may be moving to handheld computers (Newman, 2011; J. Smith, 2011). Schools may provide one or two computers in a classroom, a

lab full of computers, or laptops on a cart, but the reality is that virtually all schools now have at least some computer access (Tice, Gray, & Lewis, 2010). Even less well funded schools and school districts can boast about the equipment and software technology grants have helped to purchase (Institute of Education Sciences, 2010). Because technology is ubiquitous in everyday life, money is available for buying technology for schools. However, just because a classroom contains technology does not mean that the technology is being used in meaningful ways, either by the teacher or by the students. In some cases, it is not even being used at all (Bebell, O'Dwyer, Russell, & Hoffmann, 2010; Bebell et al., 2004).

Statement of the Problem

New technologies can be expensive because school applications for technology change so rapidly. Administrators are tasked with purchasing equipment using the available funds. When money is committed to technology resources, the assumption is that teachers are using the equipment, but on-going research that delineates the amounts and kinds of technology use in the classroom is needed to ensure that precious funding is well spent. According to administrator standards from the International Society for Technology in Education (2010) educational leaders need to ensure that schools have the necessary technology tools to meet the needs of all students. Administrators must assess new technologies, monitor trends, and use the information to build school cultures where technology promotes students' academic achievement.

There is not a clear picture of how technology influences student learning and achievement. A growing body of research sheds light on the various ways educational technology is implemented, but such research needs almost constant re-evaluation to keep up with the non-stop developments in the field. Considering the different ability levels of students

and technology's potential to deliver a multitude of resources on a given topic, using technology is clearly one strategy to provide a more individualized learning environment for students. When the learning environment is tailored to meet the needs and interests of the child, the child has the maximum likelihood of developing to his or her potential. The teacher who differentiates instruction recognizes and honors differences in development, interest, and ability among students.

In the school setting and in the extension of the school day that occurs through homework, teachers direct students' time, access, and interaction with technology (Couse & Chen, 2010). Teachers may choose between teaching the technology or teaching thinking skills supported by technology (Housand, 2011). Knowledge is no longer enough; teachers must integrate 21st century skills (Partnership for 21st Century Skills & American Association of Colleges of Teacher Education, 2010). These 21st century skills are measured by fluency in identifying a problem, locating relevant information, and delivering a thoughtful product or response (Eshet-Alkalai, 2004; Housand, 2011).

Students may have broad or limited technology choices depending on the specificity with which teachers construct assignments. Teachers make decisions about creating student-centered lessons versus teacher-centered lessons (Housand, 2011). Students' zones of proximal development, with respect to technology, may or may not match what the teacher is asking the students to do. Some students require extra technical help. In these cases, the use of technology interferes with ability to learn the content. Other students are so proficient that they can direct the computer to do the task intended to promote their learning. Teachers must have a plan to address both of these cases.

Rationale/ Theoretical Framework

Several professional organizations have offered standards to shape teachers' thinking about technology use. The purpose of the International Society for Technology in Education (ISTE) (2010) is to focus on instructional technology in kindergarten through twelfth grade as well as in teacher preparation programs. The members of ISTE have the goals of nurturing advocacy, leadership, and innovation in effective use of technology in learning and teaching. The first set of National Education Technology Standards (NETS) for students were published in 1998. Since then, ISTE members have revised the student standards and added NETS for teachers and administrators. The standards do not focus on a specific skills checklist, but rather on general attitudes and broad abilities related to a changing society. The vision of ISTE is of technology as a tool supporting the development and expression of the dispositions of a technologically literate citizenry. National Education Technology Standards for students, teachers, and administrators are at <http://www.iste.org/standards.aspx> with links for each of the sets.

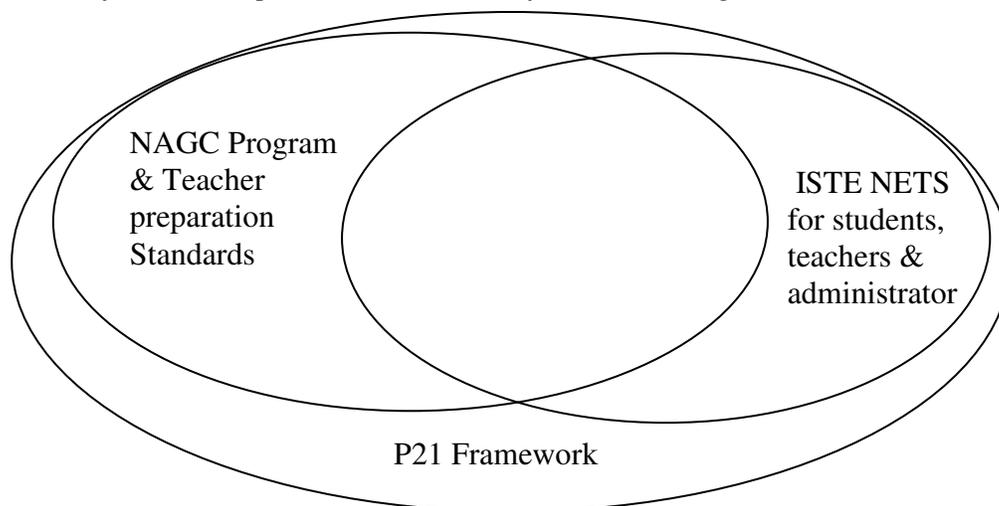
The Partnership for 21st Century Skills (P21) is a second, influential organization founded to generate a working relationship between educators and the types of businesses that will be future employers of today's students. Created in 2002, P21 is a combined endeavor by the U. S. Department of Education, several technology related businesses, the National Education Association, and a few interested individuals. The goal of this relationship is to help educate future citizens with skills that will be relevant in a workplace that is constantly being transformed by technology. The Framework for 21st Century Learning available at the website <http://www.p21.org/overview/skills-framework> was developed in 2006 and contains student outcomes and a listing of the support systems that will create the desired results. Like the NETS

standards, the framework promotes broad aptitudes that are meant to strengthen the abilities of students who will live and work in a dynamic, technology-filled world (International Society for Technology in Education, 2010; Partnership for 21st Century Skills, 2004).

The National Association for Gifted Children (NAGC) (2008) is a prominent professional organization focused on advocacy, education, and understanding of children who display gifted potential or outstanding talent (G/T). In 1998 the organization offered its first set of program standards, which have been most recently revised with the help of various educational stakeholders. The recent revision matches G/T program standards with teacher education standards, and is designed to provide high quality student outcomes through the use of research-based practice (National Association for Gifted Children, 2008). Links to these standards are available at <http://www.nagc.org/index.aspx?id=1863> . Although the evidence-based practices are fairly prescriptive with respect to teaching strategies and skills, the student outcomes are aptitudes that significantly overlap with the ISTE NETS indicators and the P21 Framework for 21st Century Learning (International Society for Technology in Education, 2010; National Association for Gifted Children, 2008; Partnership for 21st Century Skills, 2004).

Figure 1

Visual of the Overlap between Standards from Three Organizations



The similarity of goals between educators of the gifted and technology educators suggest that teachers trained in G/T education will teach in ways that support the 21st century learning goals of the P21 Framework and the NETS indicators (International Society for Technology in Education, 2010; National Association for Gifted Children, 2008; Partnership for 21st Century Skills, 2004). However, this is an empirical question. An examination of the development of the 21st century skills was too large to fit the scope of this dissertation. Thus this study focused primarily on the way teachers develop students' technology, media, and information literacy. However, technology is often taught in an integrated context where it is used to support the learning of core subjects and to develop creative productivity, areas where students who are gifted often excel. Furthermore, software programs that develop critical thinking and problem solving skills are constantly being released. Thinking skills software targets two areas traditionally taught in G/T education. Thus, the research also focused on whether teachers differentiated lessons where technology was used and, if differentiation occurred, how this differentiation was done.

This dissertation research was necessary so that educators and researchers could understand the ways in which teachers incorporated technology in their classroom, particularly with students. Personnel who provide in-service professional development and/or purchase technology for schools may be helped by understanding the specific technology needs for G/T education classrooms (Martin et al., 2010). Students received the indirect benefit of having teachers who were more aware of technology use in the classroom.

Organization of the Study

This dissertation is organized into five chapters. The first provides an introduction to the significance of the issues, a framework for understanding the proposed research, a rationale for the research, a list of research questions, a brief description of the rationale for data collection, a discussion of the limitations of the research and a glossary of terms as they are used in this research. The second chapter reviews relevant and recent literature on technology in education, instructional differentiation, and G/T programs. The third chapter explains how the research was conducted. It discusses compliance with Institutional Review Board policies, research methods, participant, setting, data collection, data analysis, and validity and reliability. Chapter four reports the results of the collected data from the qualitative multi-case phenomenological study. Data supporting the findings of the research are documented. Finally, in chapter five the results of the research are discussed and recommendations are given for further research.

Research Questions

Two constructs framed this research. The first was that the word technology, in relation to elementary education, is rarely defined or specified. The second was that training in gifted education is designed to help teachers tailor instruction to meet the specific social and academic needs of high ability students. Such instruction is necessarily differentiated.

Since some forms of technology have the potential to meet the needs of individual gifted students, the research questions that focused this study were:

1. In what ways did teachers' use of technology with G/T students shape students' technology experiences?

2. In what ways did teachers differentiate technology lessons with respect to autonomy, complexity, instruction in technology, and ability level?

Paradigm and Assumptions

In order to discover the subjective meaning behind educational technology use, the data collected were qualitative. Analysis of such data makes possible broad understandings or interpretations of how teachers use technology in education, which will have developed over time through the interaction between the cultural norms of teaching and the relationships between teachers and their students. Understanding the phenomenon of teaching with technology from the teachers' perspectives emerges out of discussion with the participating teachers (J. A. Smith & Osborn, 2004) and observations of their interactions with students. To discover this meaning the research was conducted within the context of where the teachers work. This is consistent with a social constructivist paradigm and is consistent with using qualitative methods of research (Creswell, 2007).

It was assumed that all participants were open and honest, and that participants did not alter their opinions and perspectives to please the researcher. By choosing teachers who reported frequent technology use, it is assumed that their perspectives on teaching differed from other teachers who infrequently use technology with students.

Limitations and Delimitations

A limitation of this research was that the researcher may have some bias toward the outcomes, due to her background in G/T education and her own interest in technology and how it

can be used with students. The researcher cannot fully separate herself from her perspectives, which influenced data collection and analysis. However, member checking and cross-case coding helped to decrease the influence of the researcher's interests. The amount of time spent in the field, member checking, triangulation of findings, and reflection planned into the research design increased the validity of the study. Detailed field notes and a record of coding and data decisions increased the reliability of the study (Creswell, 2007)

Not every educator who earns certification in G/T education teaches in a position as a teacher of G/T students. Some G/T certified teachers work in various administrative positions or in general education classrooms. A delimiting factor for participant selection was that the participant teaches in a position that has a title related to being a specialist in G/T education. Required teaching objectives for teachers of general education versus teachers of the G/T are different.

The number of participants in the study was small and the location of the teachers was from within the state of Alabama, so that the participants shared a common course of study. However, the curriculum taught in G/T classrooms is primarily governed by local decisions. In some circumstances the teacher of the G/T provides enrichment based on the core curriculum taught in the general education classroom. In other instances the teacher is free to teach any topic prompted by personal or student interests. Differences in teachers' levels of control over the curriculum were a limitation in the study, as they may influence what was being taught.

Additionally, not all school systems within Alabama make formal determinations about students' eligibility for G/T services. Some district use enrichment models that rely on teacher referral, school wide enrichment, or some other method for creating enrichment clusters. Some of the participants worked in school systems where they teach high ability students who are

identified using other enrichment models approved by the Alabama State Department of Education. This could be a limitation in the study due to potential differences in students' ability levels compared to those who are formally identified using the state approved definition. However, even amongst groups of students who are identified using state determined guidelines, there will still exist at least some range of ability levels.

Because preference was given to potential participants who use technology and teach 21st century skills with students, a limitation of the study was that the research did not identify aspects of technology use by teachers who use technology less often. The descriptions obtained in this phenomenological multi-case study may not be typical for all teachers, due to the small sample size and the potential uniformity in characteristics of the participants. However, transferability of findings to particular situations that have similarities to the participants in this study may be possible.

Finally, the initial selection of participants was based on extant survey data for program evaluation. The program evaluation was done to determine the perceived importance and reported effectiveness of The University of Alabama G/T certification alumni in teaching competencies from the P21 framework. That all of the participants are alumni of the same program influenced the data. Additionally, the extent to which all participants have answered the survey honestly was a limitation of the study.

Definition of Terms

Autonomy: The degree to which a teacher gives responsibility of all or part of the learning to the student. The teacher may allow student choice in the content, product, process, or learning environment. The degree of autonomy may vary from no choices and therefore

zero student autonomy, to the teacher giving two or more options from which the students may decide, to infinite autonomy with complete freedom of choice for the student. Learning tasks with greater autonomy will be more flexible than those with less autonomy. If the teacher allows autonomy for multiple students then there will be multiplicity in the learning task or environment and the teacher will have to be flexible in assessing the work. An inverse relationship exists, so that as student control increases the teacher control decreases (Elstad, 2008; Ge, Thomas, & Greene, 2006; Stefanou, Perencevich, DiCintio, & Turner, 2004).

Complexity: The degree to which the teacher explicitly or implicitly teaches students the objectives of the lesson (Lissack, 2007) The higher the level of complexity, the more the lesson relies on one or more of the following: vagueness of the assignment, interrelatedness of concepts, emergence of multiple ideas, the comprehension of multiple layers, multiple perspectives, and/or attention to weak symbols, as well as strong signals (Lissack, 2007; Rowland, 2007). When a lesson has higher levels of complexity, it is more likely that students will construct their own meanings than if the teacher has presented specific, clear information (Glanville, 2007).

Differentiation: A teaching practice that is characterized by planning for and use of different levels of ability, modes of learning, topics of interest, level of complexity, degree of explicit instruction, or other distinguishing factors by which students are grouped so that they are provided with a more individualized learning experience. The variation in the lesson for each group will be in one or more areas of the content, process, product, or environment for the lesson (Colangelo & Davis, 2003; Tomlinson, 1999).

Gifted: The field of gifted education considers the ability, performance, and characteristics of the student when determining whether he or she has the potential to display gifted behaviors. The definition for giftedness adopted in this research will be guided by the Alabama State Department of Education Matrix for determining eligibility for services. The Matrix criteria uses a score on a test of academic aptitude or creativity, a rating for gifted behavior characteristics, as well as ratings on combined performance indicators. Gifted behaviors are traits such as leadership, motivation, creativity, and achievement. Performance indicators document ability such as work samples, achievement test scores, informal creativity assessments, and grades (Morton, 2011).

Technology: A broad definition of technology is any modification that aids in completing tasks (National Assessment Governing Board, n.d.). However, in the context of this study the modifications will specifically relate to electronic devices that allow transfer of information and products between people and locations (Katic, 2008). Use of computers and other equipment with a computer chip in it; including hardware, such as laptops, desktop computers, SMART Boards, iPods or global positioning systems, and software such as word processing, spreadsheet files, presentations, multiplayer video games and other programs will be considered to be modifications that are labeled as technology.

Technology-rich environment: A classroom where a teacher regularly, purposefully, and meaningfully uses technology with students to enhance learning. In some cases, this may be at a school or in a classroom where a variety of technology resources are readily available on a regular basis to the teacher. The school may have many computers available for students to use. Supporting equipment such as SMART Boards, clickers, calculators, LCD projectors, webcams, and digital cameras, as well as other devices may

be present (Elstad, 2008). However, a technology-rich environment could also mean a classroom where a teacher has limited computer equipment and software, but who regularly, purposefully and meaningfully uses the few pieces of equipment he or she has.

CHAPTER 2

REVIEW OF THE LITERATURE

In a technology-rich society, it is difficult to determine the extent to which humans are shaping their environment with technology, and technology is shaping the environment of human culture. Computer technology has revolutionized public and private spaces, including the educational environment of schools (Kang, Heo, Jo, Shin, & Seo, 2010). Teachers do not embrace technology just because it exists, but because it is user-friendly, flexible, engaging, useful, and results-oriented (Baule, 2007). Because both computer literacy and gifted and talented (G/T) education emphasize creativity, innovation, collaboration, critical thinking, problem solving, and decision making, teachers can help students develop in both areas simultaneously through strategic use of technology in the classroom (International Society for Technology in Education, 2007; Siegle, 2004a, 2004b).

There already exists a body of research concerning the needs of G/T students. For high-end learners, teachers need to plan for and then monitor the development of curiosity, creativity, and problem-solving skills. Such development is mediated by motivation to learn, to create, and to achieve at high levels (Colangelo & Davis, 2003). Particular attention to the preservation and development of motivation should inform programming for gifted students, linked as it is with so many factors that determine both academic and lifetime success (Gottfried, Gottfried, Cook, & Morris, 2004). Acceleration of content is not enough to meet the needs of G/T students. They also require greater levels of complexity than average students (Colangelo, Assouline, & Gross,

2004; Colangelo & Davis, 2003). Technology related tasks can range in complexity from simply copying someone else's poem in order to practice typing to writing a complex paper that reports original research to creative multi-media presentations. Students may use computers, videos, and televisions as sources of information, tools for self-selected research projects, or purely for entertainment. (Ba, Tally, & Tsikalas, 2002).

Technology can be a subject by itself or a tool to aid learning in other subject areas (K. Smith & Weitz, 2003). A body of research is developing about technology in education. Student issues include access to technology (Ba et al., 2002; Neuman & Celano, 2006), use of technology (Neuman & Celano, 2006), attitudes toward technology (Boon, Fore, & Rasheed, 2007; Dove & Zitkovich, 2003; Johnsen, Witte, & Robins, 2000), technology's impact on achievement and motivation (Abelman, 2007; Boon et al., 2007; Siegle & Foster, 2001), and the potential for technology to meet students' individual learning needs (Boon et al., 2007; Siegle & Foster, 2001). For teachers, issues include their attitudes toward technology, factors influencing technology use, on-going training, and the impact of technology on pedagogy (Mueller, Wood, Willoughby, Ross, & Specht, 2008). Because, technology is expensive and is ever-changing, on-going research about technology in education is essential to guide decisions about use of time and financial resources.

This chapter discusses research on G/T education and differentiation. Next, comparisons are made among the standards from three different organizations. Then, instructional technology is discussed in terms of the different ways it is used in educational settings by various classroom participants. This review is organized according to the Partnership for 21st Century Skills (P21) Framework (2004) for 21st Century Learning. The final portion of the chapter places the proposed study topic within the body of research about educational technology.

Gifted and Talented Students

Not every G/T child grows up to be a highly productive adult. Adults who show high levels of productivity often have been encouraged to pursue areas of intense interest, to take risks with new ideas, and to use creativity in their work; all factors that increase motivation (Rogers, 1998). Students with the potential for creative productivity may find that pacing, materials, and approaches to learning in traditional general education classroom diminish their curiosity (Harrison, 2004). More traditional approaches may stifle creative students' motivation to work hard at learning. By definition, such students need to receive specialized educational interventions to meet their learning needs and help them reach their full potential. They require greater instructional intensity or higher levels of autonomy (Russo, 2004) than other students since, to a great extent, their degree of motivation influences their level of productivity (Colangelo & Davis, 2003).

The recent legislation that has mired schools in testing to ensure that they make "adequate yearly progress" has caused them to narrow the curriculum in order to focus on test preparation (Moon, Callahan, & Tomlinson, 2003). But such practices do not favor bright students. Creativity and problem solving skills can decrease over time when the curriculum offers few opportunities for students to use them (Russo, 2004).

Students work hard only when they are motivated to do so. For G/T students, motivation is increased when they have control over what they will study, how they will study it, and how they will show what they have learned (Kimball, 2001). This kind of autonomy is rare in many classrooms (Harrison, 2004). In addition, G/T students have a particular need for interaction with people who have specialized knowledge and skills in their areas of interest. Such people can constitute an authentic audience for their work or as mentors. Authenticity is strongly related to

motivation for G/T students (Kimball, 2001). Finally, G/T students are motivated by a curriculum that matches their interests and levels of cognitive development (Colangelo & Davis, 2003).

Differentiation

The need for depth and breadth of information can vary according to subject, maturity of the student, and motivation levels. However, a general characteristic of G/T students is that they are capable of synthesizing large amounts of information (Colangelo & Davis, 2003). Curriculum plays a large role in determining the context in which teaching and learning occur. All teachers, whether in resource rooms or in general education classrooms, need to provide an appropriate curriculum to meet individual student needs (Sak, 2004; K. Smith & Weitz, 2003; Zentall et al., 2001). Although in every class there exist differences in the ability, interest, and motivation of students, the flexibility and motivating nature of technology can help create life-giving learning environments (Baule, 2007; Ke, 2008) by providing students with the opportunity for differentiated instruction or tasks. Differentiation to meet academic needs may come readily to mind; however, it is also important to provide differentiation in terms of creativity. Some of the most creative students struggle to function within the framework of pullout services for G/T students where their needs inform the instructional planning (Sak, 2004).

Students identified as G/T want autonomy in their learning; they and their families are among the most proactive in shaping a learning environment that supports their growth and development (Bennett & Hertzog, 2004; Colangelo & Davis, 2003). They often pursue independent projects (Dove & Zitkovich, 2003), some of which are inspired by school work (Kimball, 2001). Rapid mastery of skills and concepts (Dove & Zitkovich, 2003; Harrison, 2004; Ysseldyke, Tardrew, Betts, Thill, & Hannigan, 2004) and leaps of understanding when

encountering new material (Harrison, 2004) often characterize the learning of G/T students. Both academically and creatively G/T, students prefer accelerated learning and the freedom to choose at least some of the topics, methods, or tools they use in assignments and tasks (Olszewski-Kubilius & Lee, 2004; Wong et al., 2006). Choice is important in fostering G/T behaviors such as creativity (Fleith, 2000) or motivation.

When students have choices around how to learn, such as by pursuing hands-on projects that integrate subject areas or by controlling the pace of their work, they are more likely to be engaged in school work. Other approaches that encourage student engagement are: flexible directions for assignments, unstructured time in which to work on projects, and the opportunity to collaborate with others based on mutual interest (Fleith, 2000).

Differentiating the levels or types of complexity benefits G/T students, who are more engaged in learning when they encounter tasks that emphasize challenge (Harrison, 2004; Kimball, 2001; Ysseldyke et al., 2004), complexity (Harrison, 2004; Savannah R-III School District, 2001), and high levels of learning (Kimball, 2001; Wighting, 2006). Technology can offer access to materials at all levels of complexity, so students can find information at the level they prefer. Gifted and talented students move relatively quickly from concrete ideas to more abstract ideas (Harrison, 2004; K. Smith & Weitz, 2003). Advanced software can allow students to process all kinds of information and transform it to suit their purposes. Gifted and talented students not only seek out complex ideas, but also want to express their own complex ideas in unique and elaborate ways. Technology allows them to actively pursue independent investigations and energetically seek the amount of intellectual stimulation they need (Harrison, 2004).

Gifted and talented students are not necessarily highly able in all subject areas (Colangelo & Davis, 2003; Swiatek & Lupkowski-Shoplik, 2000). Although, many of them read above grade

level, not all do (K. Smith & Weitz, 2003). Most report that they are bored by standard classroom reading activities, however, regardless of their actual reading ability (Hettinger & Knapp, 2001), since the vast majority of such tasks focus on lower-order thinking skills (Moon et al., 2003). Many find it more motivating to access material that would otherwise be unavailable (Olszewski-Kubilius & Lee, 2004), or to collaborate on a common project with other students geographically distant from their school (Wong et al., 2006) on topics that interest them (Zentall, Moon, Hall, & Grskovich, 2001). Reading advanced, highly interesting material online may benefit G/T students, even those who have learning disabilities in reading, more than reading yet another story from a basal reader (Zentall et al., 2001).

Comparison of Three Standards

The Partnership for 21st Century Skills (P21), the International Society for Technology in Education (ISTE), and the National Association for Gifted Children (NAGC) are three organizations that have created standards to guide educators. While there are slight differences in the organization of the concepts within the standards, there is considerable alignment among the standards. There exists significant overlap between the content of the ISTE standards and that of the NAGC standards (International Society for Technology in Education, 2010; National Association for Gifted Children, 2008); however, both of these sets of standards are contained entirely within the P21 Framework (International Society for Technology in Education, 2010; National Association for Gifted Children, 2008; Partnership for 21st Century Skills, 2004). Discussion of the P21 Framework would therefore cover the contents of both the ISTE and NAGC standards. Thus, it is the concepts from the P21 Framework that organize the rest of this literature review.

P21 Framework

Core Subjects

Student academic technology use and its relationship to engagement and academics is the focus of educational technology researchers. This section discusses some research findings about use of technology to enhance achievement in core subjects.

Especially when a technology is new or up-dated, students choose to engage with it in place of other more traditional school activities such as reading (Neuman & Celano, 2006). They recognize that technology provides easy, quick, searchable access to high-quality current information (Mohide, Matthew-Maich, & Cross, 2006). Additionally, topics may be easier to demonstrate or represent using multimedia than they are using more traditional teaching methods (Angeli & Valanides, 2009). Students who use technology believe that they learn more in both depth and breadth of a content area than those who do not use it (Boon et al., 2007; Dove & Zitkovich, 2003; Garcia & Rose, 2007; Kimball, 2001; Siegle & Foster, 2001; Wighting, 2006; Wong et al., 2006; Ysseldyke et al., 2004). Using links and having the ability to choose between exploring either the breadth or depth of a subject area makes technology responsive to learners' needs and interests.

Students, and in particular G/T students, learn more when using technology than without technology (Siegle & Foster, 2001). Student learning is reinforced and enhanced through software that aids the development of study skills and/or provides course related materials (Boon et al., 2007; Olszewski-Kubilius & Lee, 2004; Siegle & Foster, 2001; Ysseldyke et al., 2004). The same material presented by the same teacher can produce different levels of learning, depending on the availability and use of technology by the students (Siegle & Foster, 2001). In a study of self-paced math software that allowed students to explore subjects thoroughly, G/T

students typically tried a greater number of practice problems than did average students (Ysseldyke et al., 2004). When allowed to make their own selection of websites for research, children select material that interests them, regardless of whether it is written above or below grade level (Neuman & Celano, 2006; Olszewski-Kubilius & Lee, 2004).

Students use technology as a resource for both investigation and reflection (Harrison, 2004). They seek out opportunities that would otherwise be unavailable, such as formally studying subjects through distance education (Olszewski-Kubilius & Lee, 2004). Self-paced material such as Accelerated Math (Ysseldyke et al., 2004) or distance learning (Olszewski-Kubilius & Lee, 2004) provides challenge and diversification of learning.

At home when technology is available, the child has more control over how to use it than while in school. A student's technology-rich life outside of the classroom can serve to support the learning that goes on at school (Siegle, 2004b). Conversely, children who do not have access to computers outside of school may fall behind academically (Neuman & Celano, 2006).

The length of time a family has owned a computer influences levels of parental monitoring (Ba et al., 2002). The type of parental intervention used to monitor appropriate Internet access also influences achievement levels (Abelman, 2007). Authoritative parental monitoring correlates to higher student achievement; while, more authoritarian monitoring relates to lower achievement (Abelman, 2007). The authoritarian monitoring methods involve blocking access to inappropriate websites, while the authoritative style promotes critical thinking through teaching students to evaluate online information.

Learning and Innovation

In the Framework for 21st Century Learning, the section on learning and innovation addresses creativity, critical thinking, and problem solving. Additionally, it includes

communication and collaboration under this heading, as these are skills that are necessary for learning and innovation in the workplace. This section will also address these areas.

Creativity and Innovation

Creativity can be expressed either through the creation of original products, or in the approaches that students take in completing activities (Harrison, 2004). Teachers can use online sessions to develop inquiry instead of answering questions directly (Wong et al., 2006). The subject matter is unlimited when using technology as a tool for creative productivity (Kimball, 2001).

Students believe that increased time with computers helps nurture their creativity (Fleith, 2000) and they use a variety of software programs to cultivate it. For instance, role playing games on the computer allow creative students to take on other view points and express their creative ability (Zentall et al., 2001). Students expand their awareness of the world around them and their content knowledge and, therefore, grow their creativity through increased amounts of online reading and writing (Sak, 2004). Robust understandings play an important role when students are developing original projects (Wighting, 2006).

Students use the computer to communicate and share creative ideas with others (Fleith, 2000). The availability of publishing sites for text, audio, or video allows G/T students to try out publishing before an authentic audience (Dove & Zitkovich, 2003; Kimball, 2001; Savannah R-III School District, 2001). Creative students are able to seek feedback from experts who are also creative producers (Kaufman, Gentile, & Baer, 2005). Students who use technology to develop projects seek increasing complexity in their products as they gain skill in using the technology (Basham, Meyer, & Perry, 2010 ; Couse & Chen, 2010; Savannah R-III School District, 2001).

Students who spend more time online show greater skill levels in evaluation and authoring than those who spend less time online (Ba et al., 2002; Nugent, 2010).

Critical Thinking and Problem Solving

Student use of technology in working on projects and products directly or indirectly teaches them critical thinking (Matthews & Seow, 2007). Technology provides tools that can help all students develop these skills through interaction with evaluating websites and organizing information. Children practice higher order thinking when they evaluate the technology with which they are interacting (Abelman, 2007; Siegle, 2004b), determine the most suitable kind of software or piece of equipment (Savannah R-III School District, 2001), or solve problems such as how to balance homework and recreational time on the computer (Ba et al., 2002).

The very use of technology has an impact on the way that students think and learn (Matthews & Seow, 2007). Students make connections between concepts through learning how to use multiple layers of organization available on computers (Ba et al., 2002; Boon et al., 2007), as well as, exploring the depth and breadth of information in diverse subject areas to build their own concepts and connections (Boon et al., 2007).

Technology gives access to the variety of materials that can meet G/T students' need for complexity (Savannah R-III School District, 2001). Technology gives G/T students freedom to dwell with one topic long enough to probe for answers (Wong et al., 2006) or to rapidly skim sites to construct their own understanding of a great variety of subjects (Wighting, 2006).

Critical thinking helps students transfer ideas (Matthews & Seow, 2007) and be able to reason out subject matter that is normally above their grade level (Colangelo & Davis, 2003). Technology helps students develop critical thinking, such as synthesis or analysis and increases their skill levels in subject areas that require critical thinking (Angeli & Valanides, 2009; Reid &

Roberts, 2006). Technology also helps G/T students create connections between materials. Students can use technology to create connections between current events and their lives or between current events and the past (Sak, 2004). These connections require analysis and synthesis of information and ideas.

Students learn critical thinking through solving problems with technology (Ba et al., 2002; Wong et al., 2006; K. Smith & Weitz, 2003), and evaluating content that appears educational but should be subject to scrutiny (Abelman, 2007). Teachers can help students learn to question the accuracy of material or question the author's purpose in providing information. Learning to critically evaluate what they read on the Internet, rather than use of software to block inappropriate material, positively influences students' achievement (Abelman, 2007).

Communication and Collaboration

Technology allows students to communicate with other learners who share similar interests (Savannah R-III School District, 2001; Wong et al., 2006), or to communicate with experts (Dove & Zitkovich, 2003; Fleith, 2000). These experts can serve as guest speakers (Fleith, 2000), mentors (Dove & Zitkovich, 2003), or critics of students' work. Evaluators other than the teacher, whether experts or student peers, help develop students' understanding of creativity, and model and provide meaningful creative feedback (Kaufman et al., 2005).

Technology use outside the classroom can extend content learning beyond school hours and outside of the local school area (McNulty, 2002; Pachler & Daly, 2009).

Email, instant messaging, webcams, wikis, blogs, message boards, and other online Web 2.0 tools foster communication, a skill deemed important in the P21 framework, even when mentors or experts are people who live a great distance from the students or are not available at the same time the students are (Bebell et al., 2010; Coffin, North, & Martin, 2009; Pachler &

Daly, 2009; Papanikolaou & Boubouka, 2010; Savannah R-III School District, 2001).

Furthermore, the possibility of collaboration online gives students a choice about working independently or in a group on topics of interest where no local interest group exists (Wong et al., 2006; Liu, Peer, & Williams, 2006). Working with an online collaboration group gives students access to others who may be able to scaffold learning to provide accountability (Dove & Zitkovich, 2003; Johnsen et al., 2000; Pachler & Daly, 2009).

A specialized form of online collaboration and communication occurs when students use computer simulations. These are especially helpful in facilitating problem based learning because they help students utilize collaboration as students must help each other solve problems encountered in the game, and the simulations help students contextualize problems since the problems are presented within the content environment of the game (Clarke-Midura & Dede, 2010; Mohide et al., 2006; Tünzün, 2007; Wright, Burnham, Inman, & Ogorchock, 2009).

Group projects that are done using technology as a center piece can encourage students to collaborate. Basham, Meyer, and Perry (2010) gave students digital backpacks with equipment for creating a documentary while on a visit to a museum. The students who were able to most successfully complete the project were those who worked together in defined roles. The selected equipment that was placed in the backpack, in addition to the instructions given to the students, helped the students collaborate to complete the project.

Teachers shape students' experiences; whether it is using a digital backpack, taking part in an online discussion, or participating in a simulation. The teacher can provide guidance and direction, but must tailor the experience to meet the learning goals and also balance student autonomy (Coffin et al., 2009).

Information, Media, and Technology Literacy

Most students' educational interaction with computers is as a consumer rather than as a producer of new technology. Students learn to do Internet research for homework assignments, take assessments and tests, or participate in distance learning courses; rather than learning how to write programs or assemble computers. Classroom teachers decide whether learning technology skills are the main focus of a particular lesson, or whether technology will be a tool for learning other material (International Society for Technology in Education, 2010; Kimball, 2001; Savannah R-III School District, 2001; Siegle, 2004a; Wong et al., 2006). Some students report feeling that they have an increased school-related workload when technology is used for learning (Mohide et al., 2006).

Students are reported to use computers and the Internet in greater numbers than adults (DeBell & Chapman, 2005). For children the types of interaction and the volume of time spent consuming computer games, surfing the Internet, or watching television has some relationship to factors that include income level (Ba et al., 2002; Neuman & Celano, 2006), gender (Swiatek & Lupkowski-Shoplik, 2000), and availability of technology.

All children use the computer for schoolwork regardless of race, age, or income level; however, access to technology may be at school or in public places such as the library rather than at home (Ba et al., 2002; DeBell & Chapman, 2005; Neuman & Celano, 2006). The large scale *Computer and Internet Use Supplement to the Current Population* survey reports that students are using computers and the Internet in record numbers and starting at an early age (DeBell & Chapman, 2005). However, income level influences a student's access to and available leisure time for technology use. Stability in the availability of computers and the ability to afford

Internet access still accounts for some of the gap in technology use between low and middle income students (Ba et al., 2002).

Of the 49,189 students included in the *Computer and Internet Use Supplement to the Current Population* survey, 21% are living in poverty (DeBell & Chapman, 2005). Community technology access projects provide free public computers and connections on the Internet, which helps decrease the gap in access to technology for low income families (Ba et al., 2002; Donovan, Hartley, & Strudler, 2007; Neuman & Celano, 2006). Availability is important because, with decreased hands-on time with technology, students do not develop the same skills or have as much access to information as those who have stable technology resources. Students must be introduced to the technology and have time to explore it to be able to effectively use the technology (Basham et al., 2010; Couse & Chen, 2010; Nugent, Barker, Grandgenett, & Adamchuk, 2010).

Regarding the multiple aspects of the human-computer interface, the child as consumer has particular consequences for public education. Students use cell phones for calls, texting, taking photos and accessing the Internet; they participate in multiplayer interactive video games; and they browse the Internet. Thus, technology is used both for recreation and for getting school work done (Abelman, 2007; Ba et al., 2002; Neuman & Celano, 2006). The technology mastery level and the attitude of a student toward technology influences his or her fluency with technology in educational settings (Ba et al., 2002; Boon et al., 2007).

In addition to homework-related use of technology and income influencing availability, parents shape children's consumption of technology. Parental monitoring and interventions in homes with technology influence the ways that children interact with the content available through computers and television. The attitudes of parents about using technology (Ba et al.,

2002) and their comfort level in addressing issues, such as exposure to inappropriate material (Abelman, 2007), direct children's use of technology. Additionally, some parents and family member are more comfortable at trouble shooting computer issues than others (Ba et al., 2002), and this is important because students become frustrated when technology does not work as designed (Dove & Zitkovich, 2003).

Students using computers available in public places, such as the library, have different levels of support and monitoring than those using it in their homes (Ba et al., 2002; Neuman & Celano, 2006). They use public computers for more lower level activities and to view more below age level material on the Internet than students from middle income areas (Ba et al., 2002; Neuman & Celano, 2006). Library visits for low SES children tend to be less directed and less focused than those of children whose parents can provide supervision to oversee activities (Neuman & Celano, 2006).

Students who have greater access to technology outside of school have advantages over other students. Those from middle to high SES homes have more access and leisure time to use technology than students from low SES homes and they use it for a greater variety of tasks, including communication and games. They also use more advanced features, like instant messaging, than children who do not have non-stop access (Neuman & Celano, 2006).

Children from middle to high SES households are more comfortable troubleshooting technologies by themselves than children from lower SES homes. Providing formal support to deal with troubleshooting technology problems appears to be important to success with computers for lower income families (Ba et al., 2002). These factors influence students' digital literacy because children learn by doing (Couse & Chen, 2010; Savannah R-III School District, 2001).

Students seek out pertinent information as they encounter a need for it (Basham et al., 2010). Especially middle income students use family or peers to help them learn about various aspects of the computer (Ba et al., 2002). For low income students, these support structures may not be readily available.

Life and Career Skills

What a student does at home or in the community reinforces or extends his or her knowledge and skills related to technology. Both quantity and quality of computer use is important. Children who have access and leisure time are more likely to use more advanced features of the computer for communication, hobbies, or play (Ba et al., 2002). Students who spend hours doing research on a topic will gain different skills than students who spend hours playing a video game. Gifted and talented underachievers are higher consumers of recreational technology than average students, and G/T achievers use technology for entertainment in the least amounts (Abelman, 2007).

Flexibility and Adaptation

Technology assists some students to work at the same pace as their minds, when their hand cannot keep up with recording their thinking. It helps students manage task completion when routine editing interferes with developing creative ideas. For instance, students can be encouraged to type their creative writing and let the computer software help them with spelling and grammar, rather than being slowed down or distracted by their inability to spell a word (Fleith, 2000; Harrison, 2004; Myles, Ferguson, & Hagiwara; 2007).

Online students can test ideas or ways of being. Gifted and talented students' risk taking and desire for challenge can be met through technology (Kimball, 2001; Ysseldyke et al., 2004)

through safely trying activities and behaviors online that they cannot try in real life. They can adapt themselves online by being opposite to who they are in real life or to exaggerate just a few characteristics (Thomas, 2007).

Initiative and Self-direction

Teachers think that students are motivated by technology (Clausen, 2007), and students themselves report that they find technology to be very motivating regardless of subject area and topics of interest (Clausen, 2007; Couse & Chen, 2010; Johnsen et al., 2000, Wighting, 2006; Savannah R-III School District, 2001). Students find it more motivating to access interesting material on a computer rather than to read about the same topic in textbooks (Zentall et al., 2001). Motivation, due to its relationship with so many factors that determine both academic and lifetime success, is an essential component of programs for G/T students (Gottfried, Gottfried, Cook, & Morris, 2005).

Computers and televisions are sources of information for research projects (Ba et al., 2002). Technology gives students more freedom to select topics of their choice (Olszewski-Kubilius & Lee, 2004), which they find motivating (Boon et al., 2007; K. Smith & Weitz, 2003; Zentall et al., 2001). Gifted and talented students in particular pursue projects inspired by school work on their own time (Kimball, 2001). They may conduct self-directed research online (Ba et al., 2002; Dove & Zitkovich, 2003) or enrollment in distance learning opportunities (Olszewski-Kubilius & Lee, 2004).

Social and Cross-Cultural Skills

When technology is used students report feeling a greater sense of community; possibly due to increased motivation, increased collaboration, and an increase in collaborative teaching

methods (Wighting, 2006). However, schools are slow to adapt collaborative Web 2.0 technologies and, in particular, to find educational uses for technologies originally designed for social purposes (Clark, Logan, Luckin, Mee, & Oliver, 2009).

Online forums and role playing games sometimes develop their own cultures. Players may even monitor participation by members and try to guide errant players into behaving in socially acceptable ways. If the member does not conform to group standards, then it is likely that the person will be banned from participation (Thomas, 2007). In class settings where all students must participate when online forums such as discussion threads are used, the students may spend more time exploring ideas rather than developing a particular stance. It is possible this is due to students not wanting to offend others in the group (Coffin et al., 2009). An instructor working with groups online must work to shape discussion and collaboration to achieve the purpose of the course (Coffin et al., 2009; Papanikolaou & Boubouka, 2010).

Productivity and Accountability

Technology creates other forms of motivation such as providing places to publish, means to complete independent products, and access to competitions. Students are motivated by using specialized equipment (Dove & Zitkovich, 2003), as well as by using a variety of software (Boon et al., 2007; Sardone & Devlin-Scherer, 2010). Motivation stimulates students to produce higher quality products because they invest time and effort (K. Smith & Weitz, 2003).

Student interest in technology motivates them to increase behaviors related to academic success, such as recording homework assignments (Myles, Ferguson, & Hagiwara, 2007), preparing for class, and initiating research to share in class (Mohide et al., 2006). However, the processing speed of equipment, the support available, and the guidance provided by instructors

influences whether students focus more on the technology or on using the technology to deliver meaningful content (Basham, Meyer, & Perry; 2010).

Leadership and Responsibility

There are also an unlimited number of groups that can be formed through discussion boards, online games, wiki sites, chat rooms, and other ways that groups can communicate and form online. The Internet provides some anonymity between people who participate in these online forums. Students may have the same power to develop in leadership roles as adults (Thomas, 2007). Leadership can also develop when students are placed in collaborative work groups by teachers. With technology these groups need not be limited to face-to-face meeting times, but can involve students from other schools (Wong et al., 2006).

When a student is working behind a computer screen the teacher may not be able to monitor every student at all times. Students may have to take some personal responsibility for monitoring their own actions when working on computers. Teachers are concerned that students will accidentally encounter inappropriate material, purposefully visit websites inappropriate for school (Abelman, 2007; Clausen, 2007), or socialize instead of doing course-related work (Tünzün, 2007). Preservice teachers accurately predict students' actions related to computer use even if they are not correct in explaining the reasoning students used to make their decision (Kafai, Nixon, & Burnam, 2007). Preservice teachers are also able to determine the learning skills embedded in games (Sardone & Devlin-Scherer, 2010). Teachers' anticipation of how students use computers allows them to plan ahead to handle or prevent issues, and to make decisions about whether they will use computer games at all (Kafai et al., 2007; Sardone & Devlin-Scherer, 2010).

Support Systems

The ways students interact with technology outside of school settings are different than what they do within the structured school environment (Clark et al., 2009). Students see boundaries between what they do with technology in their leisure time and how it is used in schools. Exposure to technology outside of school will educate students in some way, for better or worse, with accuracies or inaccuracies in the information they absorb. School personnel can choose to work with the technology and can strive for students to be educated consumers of technology. Some schools may even choose to allow students to direct, teach, or work in support positions due to the students' ability with technology (Degennaro, 2008). Schools contain different rules and supports for technology use and troubleshooting than there is at home or in public settings such as a library (Fleith, 2000; Zentall et al., 2001).

Teachers control technology use by students within educational settings. This can mean that teachers not only control technology use during school hours, but also technology use for completing homework (Ba et al., 2002; Neuman & Celano, 2006). If students are from families who are unable to guide students' technology use, then teachers may be the support system for students' development of technology literacy. Educators have many different possible ways to use technology, just as students do, but there are differences in the purposes behind that use. These uses will be influenced not only by the various ways individual teachers choose to use technology to complete their jobs, but also by the decisions made by administrators at both the school and the district level (Bebell et al., 2010; Means, 2010).

Like students, teachers also are motivated by use of technology (Garcia & Rose, 2007). Teachers are more likely to use technology when they are familiar with it, either through training or through personal use (Shaunessy, 2003, 2007). Administrative tasks, such as keeping

attendance, recording grades, writing lesson plans and communicating with parents, are done as part of their professional requirements and do not involve working with students. However, technology can be used to help students learn. Particularly if teachers are familiar with the administrative features of educational programs that allow them to track student progress, this can influence student achievement (Means, 2010). Professional organizations and educational journals devoted to technology in education, college courses focusing on computer aided instruction, and the *No Child Left Behind Act* technology grants all work to improve technology within schools (Ba et al., 2002; Donovan et al., 2007).

This next section will focus on the research concerning teachers and technology. Teachers may be one support system for students to gain 21st century skills. Specific areas that will be addressed include standards, assessment, curriculum and instruction, professional development, and learning environment.

Curriculum and Instruction

For some teachers technology is blended seamlessly with their instruction (Clausen, 2007), but for others, many aspects of planning and organization make technology enhancements problematic (Garcia & Rose, 2007). Whether a teacher chooses to use technology or not, it is clear that the teacher has control over use of technology in school and related to school work (Kimball, 2001).

According to the Technological Pedagogical Content Knowledge (TPACK) theory of Mishra and Koehler (2005) use of technology influences the teaching of content. Interaction between the characteristics of technology and the structure of the content directs examples used in teaching content. Also, a teacher's knowledge of the content area directs the technologies selected and the pedagogy used. Finally, since the three areas interact, the teacher's knowledge

of pedagogy also will dictate the use of technology and the content being taught (Angeli & Valanides, 2009).

An extreme example of the TPACK theory would be in Internet classes. Online courses require instructors to structure the lessons around the available technology. Instructors find ways to meaningfully present content so that students will learn. These courses may be asynchronous so that teachers plan work that can be completed independently. Within these courses teachers plan for communication and find a balance between face-to-face communication (Garcia & Rose, 2007), and/or with textbooks and electronic sources (Olszewski-Kubilius & Lee, 2004). Instructors of distance learning courses have different technology-related decisions to make than those who are teaching face-to-face lessons utilizing technology. They must decide if their course will be asynchronous and what allowances they will make for students who encounter technical difficulties.

Standards

Both ISTE and the P21 Framework for 21st Century Learning serve as potential benchmarks with which teachers can measure their use of technology with students. These teaching standards emphasize teaching in ways that meet learner needs, providing a variety of methods for learning and demonstrating mastery, and promoting higher order thinking instead of rote memorization (International Society for Technology in Education, 2010; Partnership for 21st Century Skills, 2004).

Some students routinely do not complete tasks that do not challenge them because they are bored by practicing skills demanded by the tasks that for them are automatic (Zentall et al., 2001). For them, computers can be used to increase the skill level of the task. Students benefit

from differentiated instruction and all students benefit from an environment where their learning needs are being met. Differentiation is an important potential application of technology.

Differentiation provides variation for students and positive outlets for creative, nonconformist students. Teachers who use differentiation honor and recognize student strengths, interests, and abilities by providing them with different options in their education; choice is important in fostering G/T characteristic behaviors such as creativity and persistence (Fleith, 2000).

Teachers tend to use technology for topics and abstract concepts where traditional methods are lacking compared to what is available through technology. Topics that require visualization, animation, or modeling may be taught using technology. If teacher are presenting complex concepts that are dynamic, require multimedia presentation of the concept, or necessitate students being able to interact with the material, then the teacher may prefer to teach it with technology as a value added strategy over traditional teaching strategies (Angeli & Valanides, 2009).

Assessments

Technology not only helps with research, but can be used to create products that demonstrate learning (Dove & Zitkovich, 2003; Johnsen et al., 2006; Savannah R-III School District, 2001; Siegle & Foster, 2001; Taylor & Duran, 2006; Wong et al., 2006). Inclusion of creative products increases students' likelihood of academic success (Johnsen et al., 2006).

Professional Development

Teachers prefer easy and predictable access to technology (Wong et al., 2006), but the availability of technology only has a small influence on their use of technology in the classroom (Donovan et al., 2007; Shaunessy, 2007). Teachers appear to be similar to students in their

learning and comfort level with technology, in that they prefer to start with simpler applications and then gradually begin to use more complex software (Garcia & Rose, 2007). Hands-on approaches and authentic reasons to use technology help teachers learn how to incorporate it into their teaching (Angeli & Valanides, 2009).

School districts can supply teachers with in-service training that supports their development of expertise in planning lessons that incorporate both technologies that are already present in the school and new ones being purchased (Martin et al., 2010). Districts can require online collection of attendance, grades, and other administrative paperwork. College sponsored courses, in-service programs, and other technology training opportunities available through local, regional, statewide, or national administrations or organizations are designed to train teachers to include more technology in their teaching (Clausen, 2007; Fleming, Motamedi, & May, 2007; Garcia & Rose, 2007). Most appear to think technology aids students' construction of understanding subject materials (Garcia & Rose, 2007); however, some teachers still have hesitations about using technology with students.

A number of factors influence teacher usage of technology; however, it is more likely to be included in a lesson when teachers have more than basic training (Fleming et al., 2007; Garcia & Rose, 2007; Shaunessy, 2007; Taylor & Duran, 2006). Training and experience both increase teachers' reported feelings of confidence with using technology with students (Clausen, 2007).

Schools and school districts can either encourage or discourage use of technology through their planning and/or policies (Clausen, 2007; Donovan et al., 2007; Means, 2010; Olszewski-Kubilius & Lee, 2004), the support services they provide for technology implementation (Clausen, 2007; Donovan et al., 2007), the presence or lack of an organized and comprehensive plan to integrate technology, and the general attitude toward technology and its

use (Clausen, 2007). Technology availability varies not just on a district by district basis, but on a school by school or even classroom by classroom basis, depending on funding sources such as grants (Donovan et al., 2007) or levels of autonomy for teachers to determine when and how to use technology (Clausen, 2007). Teachers are more likely to incorporate technology in their lesson plans when they are sure that it will continue to be available to them (Donovan et al., 2007).

When a new technology is introduced in a large scale at a school, most teachers focus on personal concerns and reservations about it, rather than on how to use it for teaching. Personal concerns may include how to use the technology or whether it will slow down their lessons and planning. Some focus more on their perceived limitations of using the new technology rather than the advantages of the technology. Limitations may include having enough equipment for all students or fear of potential technical difficulties (Clausen, 2007; Donovan et al., 2007).

Only a small percentage of teachers initially think about ways to best use technology to improve student learning. There appears to be an adjustment period during the introduction of new technology, during which teachers work to increase their comfort level with the new equipment. After this they move to observations of how they have adopted and adapted to the new technology (Donovan et al., 2007). The challenge is moving the teachers as quickly as possible through the adoption and adaptation phases so that they begin exploring how to use the technology for quality instruction.

Teachers may only become aware of limitations in the capability of equipment as they become more familiar with new technology. Equipment failure is a drawback to technology use (Mohide et al., 2006); it impedes motivation for both teachers and students (Donovan et al., 2007; Dove & Zitkovich, 2003; Wong et al., 2006). Differences in student access to new

technologies and in their ability to use it also concerns teachers. Incompatibility between different versions of software creates frustration (Garcia & Rose, 2007).

Teachers who move to schools with active technology initiatives already in place report an adjustment period. They move through the same adoption and adaptation phases as the teachers who were there at the beginning did. However, educators who witness the introduction of new technologies in a school have different concerns than those who arrive later during the adoption process. It may be that the teachers present at the initial adoption had some say in the process; while teachers who enter late in the technology initiative process did not have a voice in the implementation (Donovan et al., 2007). The remedies for some of the teachers' concerns about using technology with students appears to be both training (Donovan et al., 2007; Fleming et al., 2007; Garcia & Rose, 2007; Myles et al., 2007; Shaunessy, 2007; Taylor & Duran, 2006) and sufficient time spent with implementing technology in their classrooms.

Availability of local support structures such as a technology coordinator or mentoring by other more experienced teachers influences both teachers' decisions about technology use and their success in using technology with students. Time, proximity, responsiveness, and availability of support structures make a difference to teachers who are technology novices. School or district level staffing of technology coordinators at full- or part-time levels also affects teachers technology use (Clausen, 2007). New teachers often find it difficult to incorporate technology in substantive ways until they have learned how to manage their own classrooms, developed long range lesson planning, and dealt with other first-year adjustments (Clausen, 2007).

Administrators realize that teachers need a variety of supports in order to introduce new technologies to the classroom, all of which, ultimately, cost. Decreased teaching loads (Donovan

et al., 2007), increased time for collaboration (Clausen, 2007; Donovan et al., 2007), attention to shared planning times with mentors, time for observations of more expert personnel (Clausen, 2007), and continued access to training in technology (Donovan et al., 2007; Koehler & Mishra, 2005) have positive impacts on teachers' technology use.

Some teachers require long-term exposure or multiple training sessions over a period of time in order to gain comfort and ease with using technology in the classroom (Myles et al., 2007). On-going in-service training can be structured around learning circles within schools (Taylor & Duran, 2006), online learning circles between various schools, or with college faculty (Koehler & Mishra, 2005). Learning circles are composed of teachers who have had extensive experience with the curriculum and newer teachers who have had less experience with curriculum but possibly more with technology. Additionally, collaboration between university faculty and local teachers assures support and learning opportunities (Clausen, 2007).

Training differentiated to meet particular needs of teachers helps them to effectively implement technology. This differentiation often relates to the extent to which teachers' adopt technology in their classrooms. When they are still concerned with how the technology changes their personal routines, they are not yet concerned with how to use it with students. After they have moved on to being concerned about how students are or can be impacted by technology, they are ready to address how to teach with technology (Donovan et al., 2007).

Possibly one of the most effective methods of increasing teacher skill in technology is providing it in a "just in time" method (Garcia & Rose, 2007). When teachers are given the opportunity to learn particular technology skills just before they have need of them in the classroom, technology use increases (Myles et al., 2007).

Some educational technology training can be done through modeling during preservice certification courses (Angeli & Valanides, 2009; Dexter & Riedel, 2003; Fleming et al., 2007; Garcia & Rose, 2007; Laffey, 2004; Murphy, Richards, & Lewis, 2005; National Council for Accreditation of Teacher Education, 2012). Preservice teachers enter education programs with a variety of attitudes and skill sets related to technology (Katic, 2008; Nail & Townsend, 2010). An increasing number of preservice teachers are entering with some experience in using technology. A majority of preservice teachers have had exposure to technology during their schooling prior to college, and some of them report computer experience due to having a computer in their home (Laffey, 2004).

Preservice teachers today appear to have less anxiety about using computers than formerly and are more likely to incorporate technology in their own teaching when they perceive themselves as having more technology skills. However, preservice teachers who do not perceive themselves as highly skilled report a greater desire to gain technology skills despite their greater anxiety than those who perceive themselves as being technology savvy (Nail & Townsend, 2010; Ropp, 1999). Some universities use technology labs to aid preservice teachers in developing required technology competencies (Bucci, 2003).

Undergraduate preservice teachers' expectations for the use of technology in their own classrooms are related to the area of education they are studying, their own experience of using technology during primary and secondary school, professors' use of technology in education courses, and the uses of technology that they observed during field experience placements in practicing educators' classrooms (Nail & Townsend, 2010; Snider, 2002). Though further research is required to determine the best practices for teacher education, access and collaboration appear to be important components (Kay, 2006). Preservice teachers report greater

proficiency in using various technologies that are incorporated in teacher education programs (Beyerbach, Walsh, & Vannatta, 2001; Nail & Townsend, 2010; Snider, 2002).

Preservice teachers who experience technology in their own college courses report that they can easily imagine ways to incorporate technology in their own classrooms (Garcia & Rose, 2007). Some preservice teachers perceive technology as interfering with development of a bond between teachers and students (Laffey, 2004; Snider, 2002). Preservice technology experiences influence teachers' conceptual understandings about the purposes of technology, and their ideas about the degree of separation and integration of teaching curriculum and technology use (Clausen, 2007). Preservice teachers who experience seamless coordination between face-to-face course time with online components, such as online discussions, see technology as a tool for learning rather than as an extra activity on top of the regular curriculum.

Modeling and hands-on use of technology during college coursework and especially during internships help in-service and preservice teachers learn by direct interaction with the technology (Clausen, 2007; Fleming et al., 2007; Garcia & Rose, 2007). Use of technology during field experiences and encouragement either by their cooperating teacher or by supervising university professors shapes future teaching practices (Dexter & Riedel, 2003; National Council for Accreditation of Teacher Education, 2012).

Teacher education programs focus on helping preservice teachers develop necessary technology skills for a variety of uses in classrooms. Computer programs help them develop professional competencies related to analyzing, organizing and presenting material. Technology encourages them to develop a variety of different methods to creatively present material to students, and to create lessons that are more inclusive for students (Davis & Falba, 2002). Preservice teachers reported using technology as a way to create student participation,

incorporate affective learning and to include higher order thinking skills in lessons (Snider, 2002).

Definitions of educational technologies differ between preservice teachers, who give a narrow definition focusing on computers, and those of educational faculty and practicing teachers, who define it more broadly and include not just equipment, but also how it can be used (Persichitte, Caffarella, & Tharp, 1999). Use and modeling of technology in teacher education programs moves preservice teachers to the viewpoint that teaching technology is part of the job for all teachers, and is more than just giving students an assignment to type (Beyerbach et al., 2001; National Council for Accreditation of Teacher Education, 2012). Preservice teachers appear to use technology more for themselves in administrative tasks than for engaging students (Dexter & Riedel, 2003).

Implementation of technology in education courses may be supplemental to the general course work, partially integrated to facilitate the course work for a class, or fully integrated with the standards and assignments for a course (Davis & Falba, 2002; Rowley, Dysard, & Arnold, 2005). Full integration of technology in a course is more likely to be perceived as an authentic use of technology by preservice teachers (Davis & Falba, 2002). Online teaching projects help preservice teachers develop technology related teaching skills. The preservice teachers discover challenges in focusing student comments on the topic, variability in the quantity of postings, and limitations in children being able to vocalize or write their understandings (W. S. Smith, Trundle, & Lee, 2003).

Faculty modeling of technology encourages preservice teachers to adopt creative and authentic ways to incorporate technology in their own classrooms (National Council for Accreditation of Teacher Education, 2012; Rowley et al., 2005; Snider, 2002; Wilson, Wright, &

Stallworth, 2003). Preservice teachers appear most likely to use technologies with which they are familiar. Teacher education programs that incorporate a variety of technologies including teacher-centered, child-centered, and task-centered technologies, help preservice teachers become familiar with different technologies (Bucci, 2003).

Faculty support and attitude toward the use of technology appears integral to successful use in the college classroom setting (Beyerbach et al., 2001; Persichitte et al., 1999; Rowley et al., 2005; Wetzel & Strudler, 2005). For preservice teachers and professors, lack of knowledge, time and support appear to inhibit the use of technology in college courses. Availability of equipment, opportunity for support, interest in using technology, and commitment to using technology tend to encourage the incorporation of technology in college courses (Davis & Falba, 2002; Persichitte et al., 1999; Snider, 2002; Vannatta & Beyerbach, 2000).

Faculty can improve technology use in their courses by soliciting data about how students used the available technology tools, and how successful the tools were in helping them. The data can be used to help move technology from being supplemental to the main course work to being an authentic integral piece of an education course (Beyerbach et al., 2001). Some data from preservice teachers and teacher education faculty indicates a desire for technology to be integrated early in the teacher education program and for there to be a planned progression of introduction to various technologies within the sequence of coursework (Ropp, 1999; Vannatta & Beyerbach, 2000).

Potential authentic uses of technology in preservice education programs include multimedia lessons that present children's work, videos of teachers teaching children, collections of artifacts, and information about the context of video lesson for observation. Use of open-ended questioning with multimedia lessons ranked as high as actual field work in helping

preservice teachers feel that they had gained competency in understanding how to manage student behavior. Multimedia presentations allow preservice teachers to mark portions, to sort material, to categorize children's work, and to have ample time working with observations. They gain pedagogical knowledge, develop attitudes about such classroom issues as discipline, and experience effective ways to use technology. Some preservice teachers report that viewing computerized simulations improved their teaching, and gave them experiences similar to what they encountered during field experiences. These computerized classroom simulations allow preservice teachers to apply educational theories to a context and to develop decision making and problem solving abilities (Baker, 2005; Labbo & Ryan, 2006; Lee & Powell, 2005).

Technology can support self-reflection and growth in preservice teachers. The development of online communities provides opportunities for collaboration between preservice teachers, preservice teachers and working professionals, preservice teachers and children, as well as others (Murphy et al., 2005; W. S. Smith et al., 2003; Walker, 2002).

Collaboration with peers in course work helps preservice teachers understand how to use technology while showing the value of collaboration within a classroom (Beyerbach et al., 2001). Collaboration between preservice teachers and current educators in planning lessons that incorporate technology increases the use of technology in the experienced teachers' classrooms. It creates bonds between teacher training institutions and schools or school districts (Murphy et al., 2005; W. S. Smith et al., 2003; Vannatta & Beyerbach, 2000; Walker, 2002). Additionally, technology creates collaboration and rich discussion between faculty members and preservice teachers (Persichitte et al., 1999; Rowley et al., 2005).

Through dialogue, preservice teachers gain direction from experienced professionals about methods, materials, lesson planning, and interaction with children (Schmidt, 2005). Via

communication using technology, experienced teachers and other professionals act as role models. They support preservice teachers through sharing of stories, giving direct instruction and clarifying concepts related to teaching (Walker, 2002). Video conferencing provides immediate guided reflection and collaboration during internships (Vannatta & Beyerbach, 2000).

Electronic portfolios can be used to demonstrate how preservice teachers have met standards and competencies required for teacher certification. Electronic portfolios utilize existing software or university-created software (Strudler & Wetzel, 2005) to address not only the personal creative content of the material in the portfolios, but also competency in the use of the technology to create the portfolios (Milman, 2005; Wetzel & Strudler, 2005). Technology competencies are encouraged by assigning the portfolio in a particular course or by designating computer lab time to support the creation of the portfolios (Strudler & Wetzel, 2005).

Portfolios encourage self-reflection in preservice teachers, confidence in technology skills, and confidence in teaching skills (Milman, 2005; Wilson et al., 2003). However, if the portfolio assignment is too cumbersome, preservice teachers may not feel they have mastered the technology, even though the university assumes that completion of the portfolio demonstrates mastery (Laffey, 2004). It is important for preservice teachers to experience that small steps lead to larger steps, that the process of the portfolio is manageable, and that the portfolio has a clear purpose (Wetzel & Strudler, 2005). If the purpose and use are not clear, the portfolio may be viewed by the preservice teachers as an assignment, rather than a tool for developing teaching skills or gaining employment. Some preservice teachers may understand the portfolio as a way to show creativity and technology competencies, but not to demonstrate teaching skills and abilities (Wilson et al., 2003). Preservice teachers' perceptions of control over electronic portfolios and their beliefs about the purpose of the electronic portfolios are influenced by factors such as

whether preservice teachers choose their best work, whether faculty prescribes assignments that meet portfolio criteria, and the amount of reflection required in the portfolio (Strudler & Wetzel, 2005).

Even with incorporation of technology in teacher education courses, continued use of technology in classrooms depends on the support that new teachers receive in their respective schools (Laffey, 2004). Technology continues to change and faculty and preservice teachers will have to adapt and learn as new technologies become available (Davis & Falba, 2002; Persichitte et al., 1999).

Learning Environment

Technology does not have to be the end itself, but can be the means to an end (Couse & Chen, 2010; Johnsen et al., 2006; Savannah R-III School District, 2001; Wighting, 2006). With repeated use, the computer becomes a tool for students. Such assistive technology can either be an unobtrusive way to help students with disabilities (Myles et al., 2007), or a learning experience for the entire class (Boon et al., 2007). Using a computer to structure breaking assignments into steps, checking answers, and giving further examples or cues helps all students write better, for example (Zentall et al., 2001).

Many techniques for meeting the special needs of G/T students are known and well researched; however, school districts do not always use these methods. Support for special services for G/T students varies in funding, resources and personnel, as well as in the time allowed for them. There is bias against using acceleration due to the misperception of social problems of the student being accelerated, and many people of the general public tend to charge that special homogenous pull-out programs promote elitism in education. Thus differentiation,

especially in the general education classroom, may be the only opportunities that some G/T students encounter to meet their particular learning needs (Bain, Bliss, Choate, & Brown, 2007).

Need for Further Research

With the pace of change of technology, it makes it difficult to develop surveys that are reliable and valid for measuring the use of current technologies. Additionally, there often are many different ways a specific technology can be used and it is hard to account for all of the possible uses through a closed survey (Bebell et al., 2004; Bebell et al., 2010; Clarke-Midura & Dede, 2010; Hall, 2010). General research may not account for the purpose of the technology use (Lagrange & Erdogan, 2009). A yes and no survey, or even use of a Likert-type scale indicating frequency of use, cannot measure the quality of implementation of educational technology (Hall, 2010). Other research methods are necessary.

CHAPTER 3

METHODOLOGY

Purpose of the Research

The overarching goal of this study was to provide a thick description and understanding from the perspective of the teacher of how teachers of the gifted and talented (G/T) incorporate technology in the classroom. Of particular interest was to examine how teachers of G/T students use technology to differentiate technology lessons.

The research questions that focused this study were:

1. In what ways did teachers' use of technology with G/T students shape the students' technology experiences?
2. In what ways did teachers differentiate technology lessons with respect to autonomy, complexity, instruction in technology, and ability level?

This chapter will address the methodology of the proposed research. It begins with a description of the Institutional Review Board process. A discussion of the research method is followed by a description of the settings in which the data were collected. Characteristics of the participants, how these participants were selected, data sources, how the data were collected, and how the analyses were completed are then described in detail.

Institutional Review Board Process

In accordance with The University of Alabama requirements, The University of Alabama Institutional Review Board (IRB) approved this plan of research. Protecting the participants' confidentiality was a primary concern and so storage of data and identifying information was carefully safeguarded. The researcher contacted each teacher participant individually through email, introduced herself, and then used a script to explain the concept of the research design, the details concerning individualized data security and protection and guidelines for participant lesson plans and interviews (See Appendix A). She discussed with administrators and participants the informed consent and answered any questions they had about the research. Informed consent forms from each teacher participant were completed before any data collection was initiated. After the signed letters of consent were returned, teacher participants were contacted to collect lesson plans, schedule interviews, and complete the classroom observations.

There were no foreseeable risks to the participants beyond use of their time. The interview was the only portion of the research that was not an activity normally associated with being a teacher. Data were kept confidential through the use of pseudonyms. The identity of the participants was known only to the principal investigator.

The main benefit of participating in the study was the opportunity each participant had to reflect on his or her teaching practices. A small technology related incentive, such as a memory card reader, recordable CD-Roms, or other computer accessory costing less than \$10 was offered to all of the participants as a thank you gift after data collection was finished. However, Abby and Bati chose not to accept any incentive other than being able to assist in data collection, and Lettie and Emilia never returned any communications about their desired incentive. Kayla

requested and was given small external speakers for her computer, and Whitney requested and was given a memory stick.

Research Method

The researcher sought to analyze and document the individual experience of G/T teachers using technology in their classrooms. The emphasis was on meaning making and examining the process rather than on a final outcome (Merriam, 1988). This research was not designed to manipulate or control the situation, but to describe and interpret classroom practice (J. A. Smith & Osborn, 2004). Therefore, a qualitative approach was used. Qualitative methods are appropriate for examining bounded systems such as life in a classroom, and is justified for pragmatic reasons if it is useful, appropriate and possible to gather data through sources found within the natural context of the phenomenon (Creswell, 2007; Merriam, 1988; Mertens, 1998; J. A. Smith & Osborn, 2004).

In phenomenological research, the emphasis is on fieldwork, but the data collection methods will fit the process being studied (Creswell, 2007; Merriam, 1988), and diverse sources of data are used (Creswell, 2007). Multiple data sources inform the emerging understanding of the issue, and it results in a holistic interpretation of the topic (J. A. Smith & Osborn, 2004). To answer the research questions for this study, data collection was done through collection of lesson plans as documentation, in-depth interviews with key informants, and classroom observations of teaching.

Case study research supports understanding of a bounded system such as an individual teacher and his or her teaching process (Creswell, 2007; Merriam, 1988) . In case study research, the emphasis is on providing understanding, discovery, and explanation of a particular situation.

Multiple case study research, another qualitative research tradition, provides examples of different perspectives on the topic (Creswell, 2007; J. A. Smith & Osborn, 2004).

Phenomenological research may be combined with multi-case study research so that multiple examples of participants who have experienced the same phenomenon are studied (J. A. Smith & Osborn, 2004). Multiple perspectives allow a richer examination of the phenomenon. This research examined the use of educational technology in six G/T classrooms.

A qualitative phenomenological multi-case study approach was used (Creswell, 2007; J. A. Smith & Osborn, 2004) because the descriptions and explanations made about teachers' technology use with students (Merriam, 1988; J. A. Smith & Osborn, 2004) were based on the teachers' perceptions. Description was used to depict how G/T teachers were using technology which provided data for thematic coding related to technology use (Creswell, 2007; Gall, Gall, & Borg, 2007; Merriam, 1988; Mertens, 1998; J. A. Smith & Osborn, 2004). Coding for themes developed as the study progressed.

It was expected that some codes would relate to descriptions of what activities were done with students, others would refer to teachers' motivation for choosing certain activities, and still others were likely to connect to teachers' attitudes towards various technology. Anticipated areas of interest were the curriculum in which lessons used technology, the degree of autonomy given to students during lessons, whether differentiation was present, and how technology was used to create the differentiation when it was present. Particular attention was paid to themes from the 21st century skills framework such as creativity, communication, collaboration, life and career skills, and digital literacy (Partnership for 21st Century Skills, 2004).

Other potential areas of interest included lesson characteristics, such as whether individual or group work was used, level of support offered by the teacher, the degree of higher

order thinking skills demanded by lesson activities, and the level of complexity seen in the lesson (Tomlinson, 1999). Additional significant themes emerged as data were collected and analyzed.

The levels of analysis ranged from classification and typology to an examination of the complexity and difficulties of using technology in the classroom. Finally, interpretations and assertions were made (Creswell, 2007; J. A. Smith & Osborn, 2004) concerning the levels of autonomy and differentiation teachers provided to students through technology, and whether 21st century skills drive technology use in lessons.

Recruitment

The sampling used for this study was purposive in nature (J. A. Smith & Osborn, 2004). Teachers, as leader and decision makers in the classroom, were the gatekeeper participants in the study (Creswell, 2007; J. A. Smith & Osborn, 2004). All of the participants were teachers who had obtained G/T education certification through the master's level certification program at The University of Alabama.

Participants were found by using an extant database of program graduates. The database was created to provide ongoing program evaluation of The University of Alabama's G/T certification program, administered in December of 2010. The survey was based on the framework proposed by the Partnership for 21st Century Skills (P21). It focused on how important teachers believed the 21st Century Skills were for their students, and how effective they felt they were in teaching those skills. The survey is included in Appendix B.

Results from the survey were culled to find teachers who both used technology frequently and shared similar attitudes and beliefs. Using this framework is significant because the ideals espoused by the framework are similar to the programming standards that are advocated for by

the National Association for Children (NAGC). In the end, six willing participants were found who cooperated with the researcher until all data were compiled.

Small sample size is typical of phenomenological research. The smaller sample size provided fewer results that are transferable, but allowed for greater sensitivity in description and data collection (Mertens, 1998; J. A. Smith & Osborn, 2004) to provide rich information about the phenomenon (Creswell, 2007).

In phenomenological case studies participant selection is deliberate so that the people were interesting and practical representations of the population being studied (J. A. Smith & Osborn, 2004). The similarity of the teachers' responses to the 21st Century Skill survey, the equality of all having obtained certification in G/T education through The University of Alabama's program, and the parallel of teaching high-ability students homogenized the sample (J. A. Smith & Osborn, 2004).

Participants & Settings

Recruitment of participants began in May of 2011 as soon as permission to complete the research was obtained. After the program evaluation database was culled, current contact information was found. Several potential participants were approached but were either unwilling to participate or did not have time to participate in the research. Initially five teachers were found who were willing to participate and whose principals agreed to the research. However, one of these participants was dropped from the study when it became evident that her personal schedule did not allow time for data collection. The database was examined again and more participants were approached. Two more participants were found and appropriate permissions obtained, so the

total number of participants in the research was six. These six participants are described in the following section.

Abby

Abby is a teacher who completed her G/T certification in 2004 and had taught as a G/T teacher for six years. Prior to obtaining her G/T certification she taught elementary school. The school at which Abby works is attended by students from middle to upper SES level families. The neighborhood surrounding the school has large homes and is located in a suburb south of Birmingham, Alabama. There are just over 500 students attending Abby's school and 99% of the students are white. It is a public school that serves children in kindergarten through sixth grade. The school is not a Title I school and none of the student are eligible for free or reduced lunch (National Center for Education Statistics, 2011).

The school district in which Abby works serves a population who has enriched home lives. Therefore, rather than using the state matrix for identification, the school system uses similar criteria to determine enrichment clusters but not to make formal eligibility determinations. The classes with which she works are small in that they have around ten students. She teaches students in third through sixth grade as an enrichment resource teacher. The students come to her classroom, and she is able to work her teaching schedule so that she is able to see students in multiple groupings. Some student enrichment groups meet because they are in the same grade level, while at other times the group of students meeting is based on interest. Therefore, some children might not have all of their enrichment time in one continuous class, but the number of contact hours Abby teaches them will total to three hours for each student. The upper elementary teachers at Abby's school are departmentalized, so Abby's class times for those particular students are blocked so that they match with class changes.

The enrichment classroom is in the basement of the school. It is a small room on a corner hallway, but it has a storage room directly attached to the classroom as well as a room with equipment used to create the school news broadcasts. Between the computers in the main classroom and those in the broadcast room, Abby almost has enough computers for each student to be able to use individually. However, there is also a school-wide laptop cart available to supplement the number of computers so that all students may work independently if desired. There is a high level of technology in Abby's classroom. The printer for all teachers whose classrooms are on Abby's hallway is housed in Abby's room. She has a projector and an iPad that are actively used. The iPad is not only employed for creating lesson plans and accessing the Internet, but Abby also plays music on the iPad in the background. Additionally, Abby has four Lego Robotics kits that she has used numerous times with the students. Abby regularly and comfortably uses the technology available to her, and even has one of her student groups based on interests focused on the topic of technology.

Bati

In 2004 Bati completed her certification in G/T education and then more recently she completed G/T certification at the Education Specialist level. She was in her sixth year teaching as an enrichment teacher, but has over 16 years of teaching experience. Bati has a passion for the outdoors and for wildlife, and this passion is reflected in her room and her teaching.

The school at which Bati works is attended by students from diverse backgrounds. The neighborhood surrounding the public school has a variety of houses and apartments and is a short distance from a major road with many different retail businesses. The school is located in a small city that is a suburb south of Birmingham, Alabama. There are about 600 kindergarten through fifth grade students attending Bati's school. The student demographics are around 50% of the

students are white, and then just under 25% of the students are black, just under 25% are Hispanic, and the remaining small percentage of students are Asian/Pacific Islanders. It is designated as a Title I school with 33% of the students receiving free or reduced lunch (National Center for Education Statistics, 2011).

The school district in which Bati works determines enrichment services by teacher referral; they do not formally determine eligibility. The classes with which she works are small so that they have around ten students. She primarily teaches students in third through fifth grade as an enrichment resource teacher, but she also works with all grade levels to create interest based enrichment clusters that are attended by all students school-wide on Fridays during the school year. The pullout enrichment students come to her classroom, and she bases her class groupings on grade level.

The enrichment classroom is located in a large classroom that used to be a science classroom lab. It has a greenhouse and a couple storage rooms attached to the main room. Bati has used furniture to break up the extra large space into distinct areas, such as areas for whole group instruction at tables, a relaxed seating area with couches, an area with multiple computers, and a section that is a pretend campfire outdoors seating area for discussion. She has a projector with a laptop and an Elmo attached that is close to her large group table area. In one corner near her desk she has a small bank of desktop computers with an additional table nearby for bringing in Netbooks if she wants all children to work on a computer independently. She moves the students between these different spaces as appropriate for the instruction that is occurring.

Emilia

Emilia completed her G/T certification in 2001 and has taught as a G/T teacher for five years in her current position. She has taught both elementary school and intermediate school.

Emilia is not the official technology leader at her school, but she provides in-services and support to increase the use of educational technology used by other teachers at her school.

The school at which Emilia primarily works is attended by students from diverse SES levels, with close to half of the student body receiving free or reduced lunches. The school is designated as a Title I school and has Title I funding to spend, some of which it has spent on technology. The area surrounding the school is mainly rural and is located in a large county in Eastern Central Alabama. There are just over 1,100 students attending Emilia's school, with 85% of the student body reported as ethnically being white, approximately 13% black, and the remaining less than 2% are either Hispanic or Asian/Pacific Islanders. It is a public school that serves children in pre-kindergarten through fifth grade (National Center for Education Statistics, 2011).

One day a week Emilia travels to the intermediate school for which her elementary school is a feeder school. There she provides enrichment services for children who were identified for G/T services in elementary school. The intermediate school, due to having an even larger student population than the elementary school, with therefore a smaller percentage of students receiving free or reduced lunch, is not designated as a Title I school. All of the observations for Emilia were conducted at the elementary school, where she has greater access to technology.

The school district in which Emilia works serves the entire county. The largest city in the county is Prattville, Alabama and there is not a separate city school district. While the county is close to Montgomery, Alabama, the county area where Emilia's school is located is primarily rural. Emilia is very conscientious of the backgrounds of her students, and she works with all of the teachers and administration to enrich the students' lives. She focuses on increasing what have

been identified as areas of weakness for many of the students at her school, vocabulary and knowledge of the world in both the geographic sense and understanding of other cultures.

The district formally determines eligibility for G/T services using the Alabama State Department matrix for identification (Morton, 2011). The classes with which Emilia works are moderate in size; they have fifteen to seventeen students. She teaches students in third through fifth grade as an enrichment resource teacher. The students come to her classroom, and she has them grouped by grade level. She only sees each group for three hours per week.

The enrichment classroom is located in a hallway along with the upper grade level general education classrooms. Emilia's classroom is typical of the other classrooms at the school, and her classroom has the same basic level of technology as the other classrooms at the school. There is one large room with a small storage room attached. In the center of the classroom there are tables for whole group work. Along the edge of the classroom Emilia has various kidney-shaped tables, grouped desks, and a small reading area. Since Emilia has class sizes that are at the maximum approved size and she has each group for the approved minimum amount of time approved (Morton, 2011), she frequently teaches using centers so that she can expose the children to several activities.

Typically, at least one or two of the planned centers involve technology and Emilia often begins the class time with a whole group lesson that includes technology. One center she frequently uses is an Eggspert response system. It is modeled to be like a game show format. There are several colorful buttons attached to a main control panel, and participating students buzz in using the buttons. As part of her centers areas Emilia also has a small bank of computers and a table where she sometimes places Netbooks. She has a SMART board that is sometimes used as a small group center and sometimes used for whole group instruction. There is also a

laptop on a cart that is attached to a projector and an Elmo that she has checked out long-term from the library. Some of her enrichment groups eat lunch with her in her classroom, and so she will plan for the whole group to watch something educational off the Internet while eating.

Kayla

Kayla began her teaching career working in physical education and then early childhood education. She was hired at her current school when it was first opened, and taught kindergarten and then first grade. In 2005, she moved to a position providing fifth and sixth grade G/T services. She completed her G/T certification in 2008. The school at which Kayla works is attended by a diverse student body, from in the surrounding neighborhoods. The school is located in a suburban area in Prattville, Alabama. There are approximately 1,300 students attending Kayla's school and ethnically 72% of the students are white, 19% are black, 4% Hispanic, 3% Asian/Pacific Islander, and then less than 1% of the student population is American Indian. It is not a Title I school, but does have 25% of its students qualifying for free or reduced lunch. It is a public school that serves children in kindergarten through sixth grade (National Center for Education Statistics, 2011).

Kayla's school district is the same district in which Emilia works. Therefore, students are determined eligible for G/T services using the state approved matrix. However, while Emilia's students are primarily from rural families, Kayla's students live in the city of Prattville. Kayla does not travel, but spends her entire week at her school serving just the fifth and sixth grade G/T students. There is another teacher at Kayla's school, who teaches the third and fourth grade G/T students, but this teacher is new to gifted and Kayla is frequently called upon to help the new teacher navigate her position.

The enrichment classroom where Kayla teaches is located in the sixth grade hallway. It is smaller than a typical classroom at the school, and has a long narrow entrance due to a storage room that is attached to her classroom. Since Kayla has limited space, she has low book shelves lining almost all of the walls, a teacher's desk in a corner with a computer, a couple of small round tables for whole group work, a small rug area, and a small table with two computers. She has placed two older useable computers in her storage room where she keeps shelves with bins that contain educational materials, as well as spaces to collect materials students bring in for various projects. Kayla does have a projector for her computer, but due to the limited space it is perched on the end of her desk area and projects onto a white wall. Kayla's classroom contains less technology than the other classrooms at her school. She jokes that, "My room is not smart enough to have a SMART Board."

The G/T students Kayla sees are grouped not only by grade level, but also according to their home room. She sees multiple groups of students at each grade level, and typically has ten to fifteen students in each group. Kayla used to visit the computer lab with her students when she wanted students to work on the computer, but due to funding cuts and changes in technology her school has eliminated the computer lab. When Kayla plans a lesson using technology she will typically demonstrate it to the whole group using her projector, and then students will either pair up or take turns using the available classroom computers.

Kayla is responsible for having her students create the yearbook, produce a school newspaper, and her students broadcast a news report on Friday mornings over the school intercom. These responsibilities shape some of the activities that she plans with her students. Kayla also began a "green" movement at her school, so that she also imbeds ideas about

recycling and other environmental issues in her teaching. She has several animals, such as fish, lizards, and turtles that live in her classroom.

Lettie

Lettie completed her certification in G/T in 2008. She went on to add on certification in administration and is currently beginning to take classes towards a doctorate in special education. Prior to teaching at her current school, Lettie taught at a sixth grade academy in the same district. Her position at the sixth grade academy was as the G/T enrichment teacher, and she was able to incorporate a lot of technology in her teaching. At the beginning of the 2011-2012 school year, Lettie moved to a position as an assistant principal at a small rural school. Her position is half time in administrative duties and half time as an enrichment teacher. There is a separate teacher at the school who provides the G/T services for the formally identified student, but Lettie provides enrichment and support for both the low ability and high ability children. Her duties as assistant principal occasionally interrupt the times she can pull her children for instruction, so her class meetings are scheduled for thirty minutes a piece.

The school where Lettie teaches is in rural Alabama along a state high way and is not visibly close to any towns or cities. It is a small Title I school serving prekindergarten through fifth grade with just over 200 students, of whom 62% receive free or reduced lunch. The student population at the school is 92% white, 5% Hispanic, and 3% of the students are black (National Center for Education Statistics, 2011). The current principal for the school was the former assistant principal. The previous principal put emphasis in using Title I funds to hire extra staff members, so Lettie and her current principal are working to bring the school's technology equipment up to date. Part of the reasoning behind using funds to update technology is that the school system will be using computers and the Internet to deliver some remedial instruction.

While Lettie does have an administrative office that is attached to the school's main office, she also has her own classroom. The classroom is typical in size and layout with other classrooms at the school, and has an attached storage room. Since Lettie pulls small groups of ten or fewer students, the classroom is arranged such that there are desks set for group work and whole group instruction in the center of the classroom. There are a couple of computers, a projector with a computer attached, a SMART Board, and Lettie frequently uses an Interwrite Mobi tablet that she moves around the classroom so that either she has it in her hands or it is in one of the students' hands.

Whitney

Whitney's original certification area was in elementary education and she taught early elementary grades for four years, including three years in a multi-grade classroom team teaching. She completed her G/T certification in 2002 and began teaching G/T then. The school system where Whitney works formally identifies students as eligible for G/T services by using the state department matrix. For many years, Whitney's school system served G/T students by busing them to a centralized location. Whitney was one of a handful of the G/T teachers in her system who piloted outreach programs to help provide information to general education teachers on how to meet the needs of G/T students. However, over the summer prior to the 2011-2012 school year, the administration in Whitney's school district transitioned to a service plan where the G/T teachers are placed in the individual schools. Due to limited teachers and funding, Whitney is itinerant to four schools. At two of the schools she provides enrichment services, and the other two schools only serve grades Kindergarten through second so she primarily provides screening to determine eligibility for the state mandated second grade child find. At one of the lower grade elementary schools, Whitney provides G/T services for an identified student in first grade who

qualified for G/T services during testing to determine eligibility under other special education categories.

All of the schools Whitney serves are either rural or rural fringe schools. None of the schools are designated as Title I schools (National Center for Education Statistics, 2011). Originally, Whitney wanted the researcher to conduct one observation at each of the two schools where she meets for pullout enrichment classes with groups of identified students. However, with a busy teaching schedule and trying to find time to learn the technology at the new schools, both observations ended up being at just one of the schools. One of the schools had a Netbook cart and the other one had a laptop cart. Since Whitney had not had time to work with the technology leader at the school with the Netbook cart, both observations took place at the school that had the laptops with which she was more familiar.

The school where the observations took place is near the center of a very small town that is about 20 minutes from a small city. The school serves just over 330 students in kindergarten through fifth grade. The student body population is 94% white, 2% black, 2% Hispanic, and the remaining 2% are either Asian/Pacific Islander or American Indian. While the schools is not designated as qualifying for Title I funds, 37% of the students receive free or reduced lunch (National Center for Education Statistics, 2011).

Whitney has a classroom that is typical of those at the school. There is one large room with storage closets and built in shelving around three walls of the classroom. Some individual desks are spaced to allow students to spread out, but most of the desks are grouped in the center of the room so that students can work in pairs or groups, or receive whole group instruction while seeing the screen where the projector is displayed. She has a few older desktop computers located at a counter in the back of the classroom; however, whenever she wants the students to

work individually on computers, she checks out the school laptop cart. The school's laptop cart consists of an old metal library book cart with laptops sitting on it. The laptops are of various ages so that some laptops have different versions of software from others and some of the laptops are prone to having technical issues that require restarting the computer. Whitney anticipates technology problems by always setting up more laptops than the number of students so that there are always computers waiting just in case.

Data Sources

Three sources of data were analyzed and triangulated: a lesson plan, an interview, and two observations. Data were collected from June 2011 until December 2011 due to the amount of time it took to obtain the appropriate administrative permissions in each school setting, and the amount of time it took to schedule and collect all of the data from busy teachers.

A lesson plan was collected from each participant as documentation of the phenomenon under study (Creswell, 2007; J. A. Smith & Osborn, 2004). After participants agreed to take part in the study and signed a consent form, the researcher asked them to supply a lesson plan via email. Information about the influence of learning objectives, student ability, technology support systems and resources can become apparent in lesson plans (Siegle, 2005). However, it was discovered that many of the participants were not required to turn in formal, elaborated lesson plans as part of their work duties. Therefore, the lesson plan collection occurred throughout the entire data collection time, with some of the plans emailed to the researcher and some collected when the researcher came to complete observations.

Two of the participants submitted two different lesson plans to the researcher so that there was a total of eight lesson plans collected. Six of the lesson plans were the subject of at

least one of the lessons that the researcher observed. Two lesson plans were from the previous school year, but for both of those lesson plans they contained significant similarities in the learning activities to what were part of at least one of the observations. The main difference between these lesson plans and the observed lessons were that different topics were used to teach similar concepts. The lesson plans contained information on the objectives, standards, resources, evaluation, extensions, and modifications the teacher had planned for a lesson using technology.

A portion of each lesson plan included hands-on technology use with students. From the lesson plans, inferences were made about how the teachers used and thought about technology in the classroom. The lesson plans were a data source and an aide to relate some of the ideas found in the interviews to actual teaching that was seen in the observations.

Lesson plan codes were anticipated that would help examine how teachers provided differentiation. General lesson plan features, such as whether and how students are grouped, specificity of website, type of technology used by students, and final products possible for students, were coded as data and examined for themes. Of interest, too, were codes that related to G/T education, such as creativity, higher-order thinking, problem-solving skills, autonomy and complexity. Finally, some codes were likely to trace the inclusion of 21st century skills in the lessons. Anticipated skills included attention to developing digital literacy, whether and how collaboration was incorporated, and an emphasis on productivity. However, as the data collection and coding progressed, other significant themes were found.

Additional anticipated coding themes included the variety of resources, whether the technology was being used for instruction or assessment, and whether there was a plan for providing trouble-shooting support (Peterson & Bond, 2004). Lesson plans were analyzed for opportunities for student engagement, the purpose designed into the lesson, activation of prior

knowledge, connections to the lives of the students, whether plans were students-directed or teacher-directed, and inclusion of opportunities for student reflection, (Zemba-Saul, Krajcik, & Blumenfeld, 2002).

The second data source was an open-ended interview that probed for beliefs related to educational technology and provided information on personal and professional technology practices (Creswell, 2007; J. A. Smith & Osborn, 2004). Semi-structured interviews allowed the participants and researcher to explore topics and ideas more diverse than those that would have been elicited by a questionnaire (J. A. Smith & Osborn, 2004).

A protocol of suggested questions and possible follow-up questions (see Appendix D) was used to guide the interview. The list of questions was developed by the researcher based on the body of literature (J. A. Smith & Osborn, 2004) concerning technology in education. In particular, the questions were developed with ISTE (2010) NETS and the P21 Framework (2004) in mind.

Questions about student-centered teaching related to technology practices, as well as questions concerning attitudes toward technology were intended to provide insight into understanding the issue being studied (Creswell, 2007). The protocol guided, but did not dictate, the interview (J. A. Smith & Osborn, 2004).

The interviews focused on each teacher's ideas, attitudes and beliefs about (Siegle, 2005) how technology should be used in education. It contained questions about the participant's thoughts about instructional technology at her school, teacher training in instructional technology, instructional technology in general, and ways for students to use technology. The coherence and decisions about the developmental appropriateness of technology lessons were areas that were also important to discuss with the teacher (Zemba-Saul et al., 2002). Questions

about what influences the individual's process of planning for technology lessons, how she handles technical support for students, and personal preferences about technology were included on the protocol. Issues such as how the teacher decided what to teach, the sequence of instruction and how the teacher dealt with technical support issues that became evident from the lesson plan or the observations, and that required further questioning (Schmidt, 2005) were asked separately through email.

The researcher conducted her own interviews, drawing on her interest in and experience of using technology with students and in teaching G/T education. This common background helped establish a relationship between the participants and the researcher.

Four of the teachers were interviewed individually, and two, who were good friends and lived close to each other, were interviewed together at their request. Participants were contacted through email or text messaging to schedule a time and place that was convenient. The interviews were done at sites chosen by the participants. Bati and Abby were interviewed at Bati's house during the summer. Whitney was interviewed at a coffee shop in a book store during the first few weeks of school. Both Kayla and Emilia were interviewed in their own classrooms during times when they did not have students present. Lettie suggested using Skype and so the researcher interviewed her using webcams on a Saturday morning.

The interviews were recorded and transcribed for coding purposes (Creswell, 2007; J. A. Smith & Osborn, 2004). Digital audio files were created using either a laptop or a digital microphone, and then the interviews were transcribed by a hired transcriptionist. The individual interviews ranged from just over 45 minutes to almost 60 minutes. The double interview with Bati and Abby lasted just over 90 minutes. The interview was determined over when the questions and information became redundant (Creswell, 2007).

Additional questions for participants that developed after observations, after interviewing other participants, or during analysis were asked via email or directly to the participant if the researcher happened to be completing an observation soon after the question arose. It is common that during other contact with participants that informal conversations may occur that could provide additional insight into the perspectives of the teacher (Siegle, 2005).

Anticipated codes from the interviews included the attitudes of the teachers in relation to how the teachers use technology themselves, how they prefer to use technology with students, and their beliefs about the purpose of educational technology. Codes related to digital literacy, such as trouble-shooting, technical support, and comfort level, emerged from the data (Peterson & Bond, 2004). Two sets of digital literacy codes developed due to the distinction between the teacher's perspective and the perspectives of the students. Anticipated codes related to G/T education and 21st century skills included the teacher's attitude toward developing critical thinking, problem solving skills, productivity, creativity, and collaboration, among other skills.

The third data source was classroom observations (Creswell, 2007). The researcher, sitting in a back corner or walking around to view students' work when appropriate, conducted two observations of each teacher and her classroom. The focus during the observation was on the teacher and the instructional moves, differentiation, and implementation of lesson plans (Siegle, 2005). Since each of the participants teaches two or more grade levels of student groups, the researcher made sure to schedule the two observation times for each participant at times when the participant was teaching a lesson that included technology and that each observation was with a different group of students who were in different grade levels. This was done to get a broader view of each participants' teaching practices, rather than having both observed lessons dictated by the characteristics of one particular group of students.

Each observation lasted at a minimum until the end of the portion of the class where technology was being used. Most of the observations lasted 45 minutes or more, but Lettie is only able to pull her students for 30 minutes at a time, which prevents longer lessons. While Lettie teaches both high-ability and low ability students, both observations were conducted with high-ability groups. The researcher took field notes, both using an observation protocol and descriptive note-taking (Marshall & Rossman, 2011). The observation protocol sheet was based on the Framework for 21st Century Learning (see Appendix E) and was designed by the researcher. A copy of the observation protocol, with some of the possible types of observation evidence to support what was being looked for in each category, is included in Table 1. The possible evidence is italicized within the cells of the protocol.

Table 1

Observation Protocol with Possible Evidence of Practice

Observation Protocol													
Supports	21 st Century Skills												
	Core Subjects		Learning & Innovation			Information, Media, & Technology Skills			Life & Career Skills				
	Subjects (Math, English, Arts, etc.)	Themes (Global awareness, financial literacy, etc.)	Creativity & Innovation	Critical Thinking & Problem Solving	Communication & Collaboration	Information Literacy	Media Literacy	ICT Literacy	Flexibility & Adaptation	Initiative & Self-direction	Social & Cross-Cultural Skills	Productivity & Accountability	Leadership & Responsibility
	Standards	<i>The subject, domain, skill, or concept that is being taught</i>		<i>Evidence of how technology is used to meet ISTE and NAGC standards relating to student dispositions</i>			<i>Evidence of how teachers promote students' skills in technology and responsible use of technology</i>			<i>The ways teachers use technology to promote learning of life long skills, as described by the Life & Career Skills subcategories</i>			
	Assessment	<i>Any tests, evaluations, or final products that are observed</i>		<i>The products, projects, or work samples used that allow students to develop the learning & innovation subcategories</i>			<i>The products, projects, or work samples that demonstrate students' developing ability with technology</i>			<i>Evidence of how teachers track or measure progress of the students' acquisition of dispositions listed in the Life & Career Skills subcategories</i>			
	Curriculum & Instruction	<i>Pedagogical decisions, how teaching strategies that use technology and the teaching content interact</i>		<i>The thinking skills and innovation competencies that are being taught</i>			<i>The ways teachers either embed technology in a lesson or teach about technology to increase students' ability with technology</i>			<i>The pedagogical strategies, particularly those strategies that incorporate technology, that teachers use to develop life and career skills</i>			
Learning Environment	<i>The intersection between content & technology so that learner's needs are met</i>		<i>The ways in which the classroom environment promotes the subcategories under learning & innovation</i>			<i>How the learning environment is structured to scaffold students' skills with technology</i>			<i>The ways the learning environment, and possibly the learning environment through online applications, promotes students' development of life and career skills</i>				

The researcher attempted to remain as a passive participant during field observations (Creswell, 2007); however, as students worked individually or in small groups using technology the observer was more of a moderate participator. In a couple of instances, the observer was available to help with minor technology issues while the participant was working with other students. During times when students were working in small groups or individually, the participants occasionally chatted with the researcher.

Lettie's position as an assistant administrator sometimes prevents her from being able to meet with her students. Due to the possibility of her schedule being interrupted by her administrative duties and at Lettie's request, the observations in Lettie's classroom were conducted via a webcam. A couple of the students were a bit curious about the webcam as Lettie set up equipment, but after that the webcam allowed for passive observations.

Anticipated codes likely emerging from observation data included the levels of autonomy, degree of innovation, variety of resources, student engagement, connections to big ideas, connections to students' lives, and degree of student reflection within the lesson (Zemba-Saul et al., 2002). Additionally, coding about the percentage of the lesson that was teacher-directed versus the portion that was student-directed, and what types of technical support were available to students were of interest (Peterson & Bond, 2004).

Themes that were anticipated to emerge from the lesson observations included: topics taught with technology, and the degree to which technology was an integral part of the lesson (Siegle, 2005). Use of technology tools and teaching strategies emerged as areas for thematic coding (Angeli & Valanides, 2009).

Teachers offered other information about their classrooms or programs that contributed to a thicker description of their use of technology, these data were also collected and used.

Examples of such data included, but were not limited to, journals, newsletters, communications with the researcher, and work samples (Creswell, 2007).

A summary of the research questions, methods for studying each research question, and anticipated codes from each data source is found in Table 2.

Table 2

Research Questions in Relation to Methodology

Question	Relation to P21 Framework	Data Source	Anticipated Codes	Supporting Citations
1. In what ways did teachers use technology with G/T students so that it shapes student's technology experiences ?	Core Subjects & themes, Learning & Innovation skills (creativity, critical thinking, problem solving, collaboration), IMT Literacy, Life & Career Skills, autonomy, productivity, responsibility	Lesson Plan (Creswell, 2007; J. A. Smith & Osborn, 2004)	Variety of resources, student engagement, accuracy, purpose, connection to big ideas, connections to students' lives, student-directed versus teacher-directed, student reflection	(Martin et al., 2010; Peterson & Bond, 2004; Schmidt, 2005; Siegel, 2005; Zembal-Saul et al., 2002)
		Interview (Creswell, 2007; ISTE 2010, P21 2004; Schmidt, 2005; J. A. Smith & Osborn, 2004)	Instruction versus assessment, technical support to students, available technology, personal attitude, teaching philosophy, technical support	(Peterson & Bond, 2004; Zembal-Saul et al., 2002)
		Observation (Creswell, 2007)	Degree of innovation, variety of resources, student engagement, connection to big ideas, connections to students' lives, student-directed versus teacher-directed, student reflection	(Peterson & Bond, 2004; Zembal-Saul et al., 2002)

2. In what ways did teachers differentiate technology lessons with respect to autonomy, complexity, instruction in technology, and ability level?	Core subjects and themes, creativity, IMT literacy, initiative & self-direction, productivity, leadership, ability in critical thinking, problem solving, collaboration, responsibility	Lesson Plan (Creswell, 2007; Siegel, 2005; J. A. Smith & Osborn, 2004)	Variety of resources, accuracy, purpose, connection to big ideas, multiple representations, activation of prior knowledge, connections to students' lives, student-directed versus teacher-directed	Zemal-Saul, Krajcik, & Blumenfeld, 2002)
		Observation (Creswell, 2007; Siegel, 2005)	Technical support, purpose, connections to big ideas, multiple representations, activation of prior knowledge, connections to students' lives, student-directed versus teacher-directed	(Peterson & Bond, 2004; Zemal-Saul, et al., 2002)

Data Analysis

All of the data not already in text form was converted into transcripts or narratives. As is traditional with qualitative research data, the texts of the lesson plans, interview transcripts, and field notes were analyzed for themes. Beginning with the lesson plans, in an iterative process, the first participant's lesson plan was examined for both explicit and implicit codes. When finished with the first participant's lesson plan, reading began for the lesson plan of the second participant. This lesson plan was then examined for both the codes that emerged from the first participant's lesson plans, as well as for new codes. If new codes were found, then the first participant's lesson plan was reread. This same process of examining for existing codes and the rereading for newly discovered codes continued until all of the participants' lesson plans had

been read for all of the codes that emerged. Then the process was repeated for the interview transcripts, and followed by the same process for the observation field notes.

Reanalyzing data ensured that if a theme was present only a small number of times in one participant's data that it was not missed during initial coding. This analysis and reanalysis process continued over and over until a cohesive body of codes had been discovered (Creswell, 2007; J. A. Smith & Osborn, 2004). Multiple reviews of the data were necessary.

As units of data were segmented, they were collected and organized using a computer spreadsheet to aid in recording data and manipulating it for analysis (Creswell, 2007). Data from the lesson plans, the interviews, and the observations were first coded and then analyzed for patterns of themes that created a description of classroom environments that use technology (Gall et al., 2007; J. A. Smith & Osborn, 2004). Thematic coding was both within-case and cross-case in nature, and themes emerged from similarities or differences among teaching contexts (Siegle, 2005) and characteristics of participants (Creswell, 2007; J. A. Smith & Osborn, 2004). Additionally, cross-case analysis helped yield an understanding of how differences in teachers' conceptions of what instructional technology means and how it should be implemented influenced their use of it (Siegle, 2005).

Following traditional qualitative practices, an emerging research design was used. Data analysis co-occurred with data collection. Analysis influenced collection and vice versa. As data were collected, they were broken in to meaningful units for analysis. These units were managed using the Google docs online spread sheet that is similar to Microsoft Excel software. This was used so that units could be manipulated, grouped and juxtaposed to help codes and themes emerge, as well as for ease of access to data across multiple computers. When higher level

functionality of sorting data than what is possible in the Google program was needed, then the data were exported to Microsoft Excel.

Reflection on the data was important in developing an understanding of instructional technology use. The researcher anticipated and created codes, related categories, kept code frequency counts, found illustrative cases (Siegle, 2004b), and developed generalizations as ways of promoting reflection about the data. These forms of reflection were aided by the manipulation of data available through the use of spreadsheet software. The researcher was able to group data to allow for the frequency counts of individual codes and to see how different themes related to one another, and across different data sources. The researcher kept a record of ideas, interpretations, themes, and decisions that emerged throughout the study (Creswell, 2007).

Both direct interpretation and categorical aggregation of codes were possible with these data sources. The emphasis was on creating a rich description and not on generating generalizability of the findings; however, patterns and naturalistic generalizations emerged from the data (Creswell, 2007; J. A. Smith & Osborn, 2004). Due to some of the common demographics of the sample, it was possible the background experiences of the participants strongly influenced their teaching with technology, and thus life stories may emerge from this research (J. A. Smith & Osborn, 2004).

Member Checking and Triangulation

Sharing transcripts and field notes, to verify accuracy, with the participant from whom the data were collected is a form of member checking. In qualitative research, member checking is done to increase the validity and accuracy of findings (Creswell, 2007).

Once data collection was completed, participants verified the accuracy of the data. They gave confirmation of the logic and sufficiency of the coding and analysis through member checking for accuracy of themes. This was done via email.

Another method of increasing the validity of qualitative research results is the use of triangulation. This method relies on finding multiple methods of collecting data so that data are supplied from three or more sources of information. These multiple sources then provide corroborating evidence of the participant's perspectives (Creswell, 2007). The three data sources that were used to triangulate information in this study were use of lesson plans, interviews, and observation field notes. The data from these three sources provided a more complete picture of technology use in G/T classrooms, as well as themes from one data source verifying themes from another source.

Summary

In short, the proposed study examined teachers' use of technology with students. The emphasis was on creating a description and understanding of current practices. Research questions allowed focus on types of technology use related to 21st century skills, standards of G/T Education, and the National Educational Technology Standards from the International Society for Technology in Education.

Qualitative research data, as part of a multi-case phenomenological study, was collected for six participant teachers with certification in G/T education obtained from The University of Alabama. The data included triangulation through collection of lesson plan documents, interviews, and field observations. Analysis was conducted by breaking the data into meaningful

units, reflecting on the data, and coding the data for themes. The next chapter reports the data that were collected and the coding and themes that emerged during analysis of the data.

CHAPTER 4

RESULTS

Introduction

In this chapter, the results of the data will be discussed. The research questions focusing this qualitative study were:

1. In what ways did teachers' use of technology with gifted and talented (G/T) students shape the students' technology experiences?
2. In what ways did teachers differentiate technology lessons with respect to autonomy, complexity, instruction in technology, and ability level?

Research question one is broad in nature and the research study methodology provided a descriptive answer to it. Research question two is a subset of question one. The differentiation a student encounters in a lesson using technology will shape his or her experience with technology.

The chapter begins with a discussion of the data that includes information about the nature and frequency of each theme, as well as a concept map showing the relationships between themes and the codes that informed each theme. The reporting of the results proceeds first with themes relating to the teacher, then issues about equipment, next pedagogical decisions, and finally student-centered themes.

The data, collected from six teachers between July and November 2012, yielded a large quantity of information to code. The eight lesson plans yielded 87 data segments, the interviews produced 669, and the twelve observations contained 261. The data from each of the three data

sources were each determined to have between one and five different code names identifying the central concepts found within each segment. Some of the concepts were explicit, but for some, careful reflection was required to tease out the implicit ideas. There were 2891 code names found in the 1017 pieces of data, with 265 names found in the lesson plans, 1949 names in the interviews, and 677 names in the observations.

Analyses

A reflective journal was kept as codes were labeled and themes emerged. From the data 48 codes emerged that relate to how the teachers interacted with educational technology. Seven of these codes overlapped extensively with others due to slight differences in perspective between data sources, so they were combined. This produced 41 codes that were found across the three data sources.

An analysis was done to determine the more important themes in the data by calculating the percent each theme appeared in the data. A summary of the frequency of the occurrence of each code word in relation to the results of the data is included in Tables 3.

Table 3

Frequency of Codes in the Data

Code	Total Count	Percent in Data
Assets	272	9%
Support	260	9%
Tech-literacy	209	7%
Pedagogy	200	7%
Attitude	187	6%
Expertise	175	6%
Resource/tool	151	5%
Practice/hands-on/experience	125	4%
Influence	118	4%
Integration	96	3%
Life	89	3%

Characteristics	74	2%
Flexibility/personalization	67	2%
Partitioning	59	2%
Context	57	2%
Timeliness	52	2%
Authenticity	50	2%
Process	49	2%
Constraints	44	1%
Engagement	42	1%
Funding	42	1%
Responsibility	37	1%
Purpose/accuracy	36	1%
Collaboration	35	1%
Pacing	32	1%
Bonding	31	1%
Caliber /quality	31	1%
Climate	29	1%
Planning	28	1%
Critical-thinking	25	1%
Scaffolding	25	1%
Cognition/ thinking	23	1%
On-demand	15	1%
Prevention	14	0%
Opportunity	12	0%
Complexity	11	0%
Mentoring	9	0%
Connection	8	0%
Expectation	8	0%
Distribution	6	0%
Reflection	6	0%

Just under 10% of the data discussed assets, the technology equipment and software available to the teacher. Similarly, technology support for the teacher and the students also was present in just under 10% of the data. The next most frequent codes in the data were about the development of the technical-literacy of the students and discussions of pedagogy. Three other codes comprised at least 5% of the data set: attitude, expertise, and technology as a resource tool. Thirty of the other 34 codes each accounted for less than 2% of the data.

The interview data set was much larger than the data sets from the other two sources. Thus the codes found in the interviews occurred the most frequently in the total data set. Since not all codes appeared in every data set, a second analysis considered the frequency of codes in relation to the data sets in which they occurred. Summaries of the frequency of the occurrence of each code word in relation to each data source are found in Tables 4, 5 and 6.

Table 4

Frequency of Codes in the Lesson Plans

Code	Total Count	Percent in Data Source
Practice/hands-on/experience	78	29%
Purpose/accuracy	36	14%
Authenticity	29	11%
Process	20	8%
Resource/tool	17	6%
Prevention	14	5%
Integration	11	4%
Responsibility	9	3%
Expectation	8	3%
Flexibility/personalization	8	3%
Caliber /quality	7	3%
Cognition/ thinking	6	2%
Distribution	6	2%
Reflection	6	2%
Collaboration	5	2%
Pacing	5	2%
Assets	0	0%
Attitude	0	0%
Bonding	0	0%
Characteristics	0	0%
Climate	0	0%
Complexity	0	0%
Connection	0	0%
Constraints	0	0%
Context	0	0%
Critical-thinking	0	0%
Engagement	0	0%
Expertise	0	0%
Funding	0	0%
Influence	0	0%

Life	0	0%
Mentoring	0	0%
On-demand	0	0%
Opportunity	0	0%
Partitioning	0	0%
Pedagogy	0	0%
Planning	0	0%
Scaffolding	0	0%
Support	0	0%
Tech-literacy	0	0%
Timeliness	0	0%

The three issues that appeared most frequently in the lesson plans were practice, purpose, and authenticity. The practice code was defined as the time the teachers plan for students to have hands-on experience with practicing how to use technology and to develop technology skills. Purpose related to teachers' concern for developing the students' understanding of the reasons for using specific technology in specific ways. Authenticity was when students used technology for projects that were the same or mimicked how technology might be used by adults.

The shape of this data set is quite distinct from the overall shape of the data. One topic predominated: hands-on practice for the students. Six codes comprised 73% of this data set, with 10 codes sharing the remaining 27% of frequency. Twenty-five of the codes were not present at all in this data set.

Table 5

Frequency of Codes in the Interviews

Code	Total Count	Percent in Data Source
Assets	272	13%
Support	168	8%
Attitude	161	8%
Expertise	141	7%
Resource/tool	134	7%
Tech-literacy	131	6%
Pedagogy	127	6%
Influence	118	6%

Constraints	102	5%
Life	89	4%
Integration	85	4%
Characteristics	74	4%
Partitioning	59	3%
Context	57	3%
Timeliness	52	3%
Practice/hands-on/experience	47	2%
Funding	42	2%
flexibility/personalization	31	2%
Process	29	1%
Planning	28	1%
Responsibility	28	1%
On-demand	15	1%
Mentoring	9	0%
Authenticity	0	0%
Bonding	0	0%
Caliber /quality	0	0%
Climate	0	0%
Cognition/ thinking	0	0%
Collaboration	0	0%
Complexity	0	0%
Connection	0	0%
Critical-thinking	0	0%
Distribution	0	0%
Engagement	0	0%
Expectation	0	0%
Opportunity	0	0%
Pacing	0	0%
Prevention	0	0%
Purpose/accuracy	0	0%
Reflection	0	0%
Scaffolding	0	0%

The code labeled assets available to participants was the most frequent code in the interviews, appearing in 13% percent of the data. Available support for teachers and students using technology and the teachers' attitudes about technology together accounted for 16% of the data. Six codes comprised 37% of the interview data. Fourteen codes each were less than 5% of

the interview data, but together totaled 31% of the data. The remaining 18 codes were not present in the interview data.

Table 6

Frequency of Codes in the Observations

Code	Total Count	Percent in Data Source
Support	92	14%
Tech-literacy	78	12%
Pedagogy	73	11%
Constraints	44	6%
Engagement	42	6%
Expertise	34	5%
Bonding	31	5%
Collaboration	30	4%
Climate	29	4%
Flexibility/personalization	28	4%
Pacing	27	4%
Attitude	26	4%
Critical-thinking	25	4%
Scaffolding	25	4%
Caliber /quality	24	4%
Authenticity	21	3%
Cognition/ thinking	17	3%
Opportunity	12	2%
Complexity	11	2%
Connection	8	1%
Assets	0	0%
Characteristics	0	0%
Context	0	0%
Distribution	0	0%
Expectation	0	0%
Funding	0	0%
Influence	0	0%
Integration	0	0%
Life	0	0%
Mentoring	0	0%
On-demand	0	0%
Partitioning	0	0%
Planning	0	0%
Practice/hands-on/experience	0	0%
Prevention	0	0%
Process	0	0%

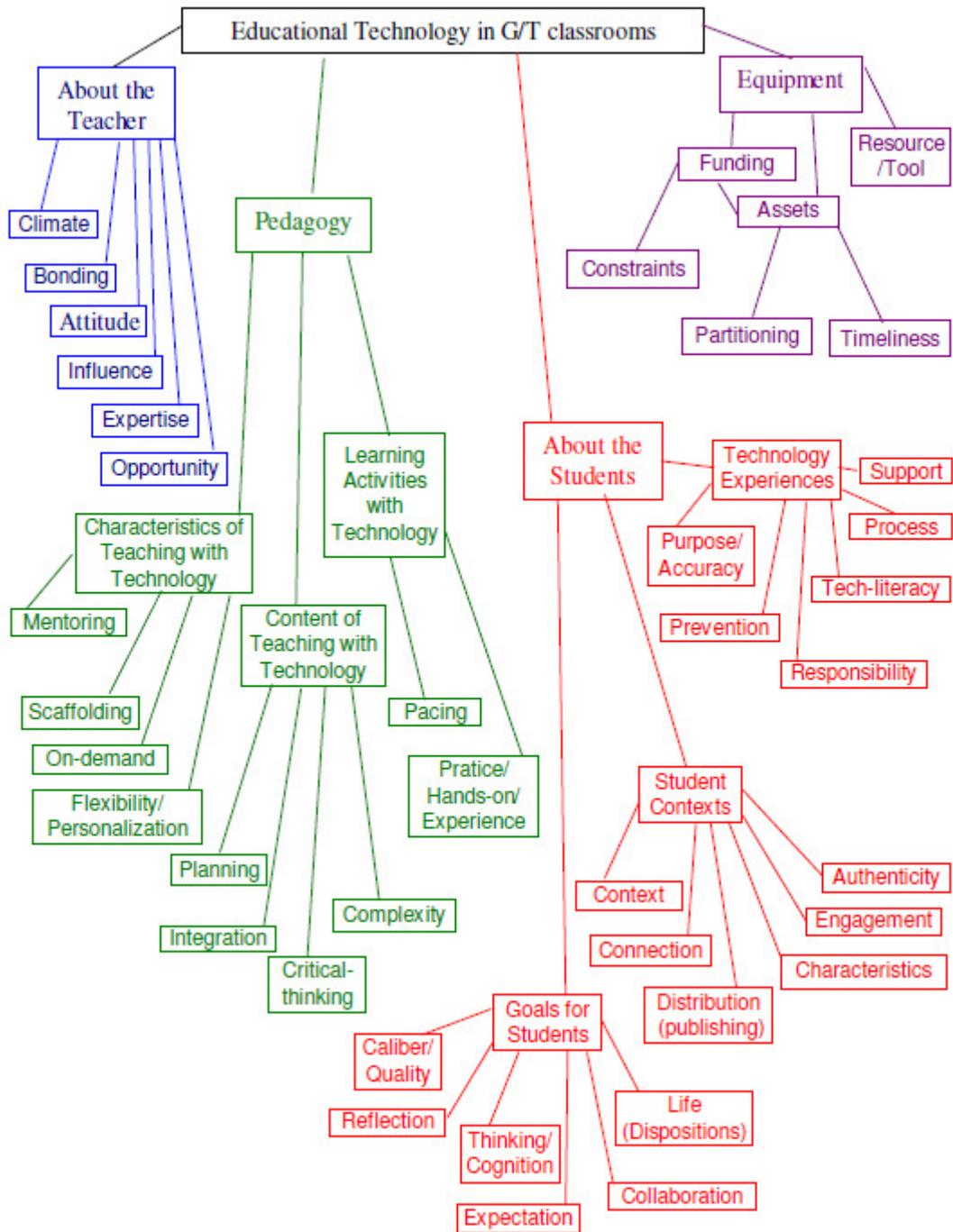
Purpose/accuracy	0	0%
Reflection	0	0%
Resource/tool	0	0%
Responsibility	0	0%
Timeliness	0	0%

In the field work data, available support of teachers' and students' technology use was the most frequent code, followed by development of technology literacy and pedagogy. These three codes comprised 37% of the data. The rest of the codes each appeared in 6% or less of the observation data. Constraints placed on the teachers from outside factors, student engagement, teachers' expertise with technology, and the level of bonding within the classroom accounted for 22% of the data. The remaining 43% of the data was comprised of 13 codes that each appeared in less than 5% of data segments. There were 21 codes that did not appear at all in the observation data.

The codes were then sorted and arranged to create four categories of relationships between and among the themes: characteristics related to the teacher, issues related to the technology equipment, topics concerning pedagogical features, and factors regarding students. A concept map demonstrating the relationships between the categories and themes is found in Figure 2.

Figure 2

Concepts Describing G/T Teacher's Use of Technology



One analysis compared the percents of the codes that made up each of the four themes. The category of teacher issues focused on expertise, attitude, climate, bonding, influence, and opportunity, making up 17% of the coding. Codes about equipment included funding, assets, resources or tools, timeliness, partitioning, and constraints and accounted for another 21% of the total. Pedagogy included personalization or lesson flexibility, on-demand teaching, mentoring, integration, scaffolding, hands-on experience and practice, pacing, planning, complexity, and critical-thinking and represented 22% of the coding. Student issues influencing technology use included building life-long dispositions, general cognitive dispositions and specific thinking skills, reflection, caliber or quality of work, expectations about author’s purpose, collaboration, connections to students’ lives, engagement, context of the students’ particular demographics, characteristics about the students themselves, authenticity, distribution, tech-literacy development, purpose or accurate understanding of technology, process knowledge, technical support, prevention of problems, and development of responsible online behaviors. These 17 codes represented 38% of the coding. Thus issues relating to students represented the most important category for themes within the research, with pedagogical decisions ranking second.

The frequency of the coding for the data segments from each data source in relation to the themes is shown in Table 7.

Table 7

Frequency of Coding for Themes by Data Source

Theme	Lesson Plans		Interviews		Observations	
	Count	Percent	Count	Percent	Count	Percent
Teachers	0	0	420	20%	132	19%
Equipment	17	6%	661	32%	44	7%

Pedagogy	102	39%	342	17%	189	28%
Students	146	55%	628	31%	312	46%

In the lesson plans, issues related to students was the most frequent theme, and issues related to teachers were not addressed at all. The subject of equipment was the most frequent theme in the interviews, followed by issues about the students. The most frequent theme in the observation data was about students.

Another analysis was done to determine the frequency of themes within the whole data set. The summary of this information can be found in Table 8.

Table 8

Frequency of Themes in the Data

Theme	Total Coding Count	Percent of Total Codes
Teachers	552	19%
Equipment	722	24%
Pedagogy	633	21%
Students	1086	36%

Thus although equipment and teachers were each comprised of six codes, equipment had a higher occurrence within the data set. The category of codes related to the theme of issues about the students had both the highest number of codes related to it and also occurred the most frequently in the data.

What follows is a discussion of the codes and themes, with evidence and descriptions from the data, demonstrating each theme's emergence from the data.

About the Teacher

During data collection and analysis commonalities among all participant teachers were found, including shared teaching philosophies, attitudes of the teachers towards technology, and the classroom climates created by the teachers. This section addresses the theme of commonalities between the G/T teachers in terms of the codes that related to technology use by those teachers.

Teachers in the position of providing services for G/T students may have students for consecutive years, smaller class sizes, some freedom in choosing topics for instruction, and approaches to teaching that use projects that promote creativity and critical thinking (Colangelo & Davis, 2003). The theme about the teacher dealt with both the characteristics of the G/T classroom that influenced students' experience with technology and the teachers' expertise with technology. Characteristics of the G/T teachers that shaped students' interactions with technology included the climate of the G/T classroom, the bonding achieved between the teacher and the students, the general attitudes of the teacher, and the development of expertise with technology by the teacher.

Climate

Climate was defined to include the classroom's physical layout and the general atmosphere set by the teacher. In most cases, the classrooms were arranged so that desks with computers, whether portable or desktop computers, were close together, enabling the teacher to work simultaneously with as many students as possible. This was true in four of the six classrooms. The size of Kayla's classroom limited the space she had for computer, which were grouped in two different places. For Abby, the limiting constraint was imposed by the broadcast room; her one Macintosh computer was required to stay there. Thus, both teachers spent time

walking between the two areas to be available to all students. Despite the proximity of the computers to each other, the G/T teacher was not so readily available to the students that she could always put her hands on their computers. An example of this is in Bati's classroom. While students worked at their computers, she sat at her desk. She could physically see what each student was doing, but would have to get out of her desk to model something on their computers. From her desk, she could verbally walk students through whatever issues they encountered while watching the steps they took. She could also see when they were beginning to become frustrated.

The teachers did not appear to specifically plan differentiated instruction for the students; however, the teachers did allow areas within each learning experience where students were given autonomy. Abby said,

Whereas just the nature of my classroom environment is, I'm okay with, I trust my students to kind of, let them have a little more freedom... but I don't have to stand over them step by step by step. And that's frustrating to them if I were to do that. They come to my room for a break from that kind of structure.

Student choice varied from decisions about appearance of end products, the specific content studied within the overall framework of the unit in progress, and the locations where students would complete work. Emilia and Abby allowed students to move laptops or Netbooks to different parts of the room. Whitney allowed students to choose the specific species of horse to study as part of a unit about the book *Black Beauty*. Bati allowed students to choose among animals native to Alabama as the topic of a fake Facebook page that would be entered in a contest about Alabama animals. The teachers indicated that they usually had a few quality websites selected for students to find content, but that these websites were just starting points as students were allowed to find their own websites. Whitney linked content for units on her class

wiki, and Bati and Abby both loaded website links to a shared server at each of their schools. The students could start with the teacher selected websites and then search out other websites that meet their needs.

Choice was also encouraged when it involved creativity. Kayla's students were allowed freedom to choose pictures, layout, font, and more for their press passes. In Bati's classroom she encouraged the students to answer portions of the animal Facebook information in creative ways. Bati said, "I'm still, you know, such a big fan of creativity and risk. It's just, take a risk and be creative. There's so much you can do."

The teachers used technology to create a relaxed, flexible atmosphere in their classrooms. Abby, Kayla, and Emilia all had music playing from computers, iPads, or other audio devices during the observations. Students were not necessarily required to raise their hands and were encouraged to interact with other students. In several of the classrooms, the teachers had policies that the students should ask each other for help with technology before approaching the teacher. Kayla said,

But I also want them to feel safe, and comfortable, especially in this classroom, because a lot of times they don't always feel that way in a regular classroom because of everything that goes on in there. So I do want them to feel safe

Bonding

The term bonding refers to the relationship that the G/T teachers built with their students. This relationship was evident during the observations and, to some degree, in the interviews. The bonding can be seen in the level of trust the teachers have with the students, the familiarity the teachers have with the students' abilities, the level of knowledge teachers have of the students' interests, and the grasp they have of what motivates each of the students.

All of the G/T teachers in the study saw roughly the same group of students for two years or more. Emilia explained,

I keep the kids third-, fourth-, and fifth-. So by the time, they're with me. Like I'm learning them, their personalities right now. Fourth, they're getting a little bit more, that I can let them be independent. By fifth grade I know who can do what. So it's kind of, if you have them for a while you're able to see what they know

This longevity of contact built a level of trust with the students evident in the interactions reported in the interviews and seen in the observations. During the interviews Bati and Abby both discussed the issue of trusting students with hands-on use of particular equipment that other teachers in their schools did not allow students to touch. Bati commented that she believed it was important for all teachers to establish a rapport with their students. She said, "Yeah, but I think even classroom teachers, if they don't, they need to build that rapport with their kids. I think that helps."

Abby offered this analysis of the dynamics of life in her classroom:

I mean I'm sure that there's ways that we use the computer that they [general education] don't, but. I can't think of anything in my classroom that I don't let them use. But I'm, I mean, I'm very laid back, and I have a very good relationship with my students, because I have smaller groups and I've known them for years. So we have probably a different level of trust than if I was a classroom teacher. But, I mean, there's not much that's off limits.

During the observation, Kayla gave her students freedom both to carry the digital cameras, which she stressed "cannot be replaced," and to freely wander the school to take pictures and then come back to class. Abby trusted students to retrieve laptops from the laptop

cart in an upstairs hallway, and hand carry them, rather than moving the cart. Lettie walked around her classroom and handed the Mobi Tablet to individual students whenever the students had answers they wanted to add.

In the interviews all of the teachers described times when they had relied on students to provide technical support for technology. One time, while working with a mini-class of students who did not receive G/T services, Abby was unsure about how to do something with her Lego robot kit. She ended up relying on one of her enrichment students to guide her so that she could guide the other students. Examples of teachers' comments during the interview included:

Whitney: Well, I mean, like, for example, when we were doing one of our CSI lesson, one of the kids said, "Hey, there's this great CSI website on"— I can't remember what it's called— like something like "Funbrain," or something like that, and we go to it and I was like, "Yeah." I mean if it pertains to the material I want them to go to it.

Emilia: If I'm working on the laptop and something's not working, I'll even ask the kids, "What do you think about this?"

During the observations the students joked with their G/T teachers. In Kayla's classroom, the students have a choice about whether to refer to her as Mrs. Kayla or to use her last name. Most of the students preferred to use her first name.

Attitude

The term attitude was defined to include the general disposition, beliefs, position, or orientation (Dictionary.com, 2012) held by the teacher. The G/T teachers exhibited commonalities in their attitudes that were evident both in their interviews and the observations.

Particularly in the observation data, it emerged that each of the teachers had a sense of a personal mission in relation to her teaching. Each participant had a premise around which much

of her teaching topics focused. For Bati it was her love of science and the outdoors. The projects she discussed in her interviews, the materials in her classroom, and the observed lessons all centered around helping students to discover the outdoors and, in particular, animals. Emilia believed very passionately about boosting the performance of her students, and the school in general, in academic areas. She not only worked with her own students on vocabulary development and exposure to other cultures and geography concepts, but provided in-service programs and resources for other teachers to do the same. Kayla's area was recycling and promoting "green" initiatives. She had worked with her students to start school-wide recycling, and to create posters and boxes related to helping the environment and which could be seen all over the school. Whitney and Lettie were mainly concerned with broadening the viewpoints of their students who came from rural backgrounds and had limited life experiences. Abby seemed mainly concerned with nurturing her students' interests and used common interest rather than grade level in scheduling G/T instruction. This sometimes meant that some students' enrichment experience was broken into pieces, rather than it happening in one continuous time.

Each of the participants approached technology and teaching with a sense of curiosity. As Kayla said,

I'll try something; I might not get it. And I can't think of any particular thing that I would say, "Oh no, I'm not going to touch that." I mean, I'm going to touch it. Because I'm one of those type people.

The G/T teachers actively sought out learning opportunities about educational technology. They had an attitude of being a life-long learner. They had all attended state level conferences and in-service opportunities that included instruction in using technology for educational purposes.

The teachers all used the concept of “play” and “risk-taking” to explore new technology, either when they did it themselves or when they introduced new technologies to students.

Talking about personal technology use, Kayla believed she needed time to play to be able to learn her new cell phone. Whitney contrasted herself to her mother, who was also a teacher, saying that she figured out how to do things with technology using trial and error, and her mother was afraid to touch anything for fear of breaking it. Students had freedom in learning how to use new technology. In many of the classrooms the students were given time to experiment and “play” with new equipment prior to instruction. Bati explained that in her classroom, “We kind of do it backwards. You know, let’s play and discover, and then ‘hey, guess what? These are some things you can do with this.’ And then sort of go into the things you could do.”

Each teacher actively sought out new technologies they wanted to try and wished they had in the classroom. Several of the participants expressed an interest in exploring technologies they had either seen or heard of other teachers using, or had been exposed to at conferences.

Emilia said,

...when the state used Elmo three or four years ago, I came back going, I want an Elmo. And I came looking and researching, seeing how I could, you know, get one. And they had not heard of them. Now, of course, you know, they’re everywhere.

Whitney, Emilia, and Bati mentioned a desire to explore quick read (QR) codes, and Lettie, Emilia, Kayla, and Bati wanted to explore using iPads with their students. Even Abby, who works at a school with many technology resources, wished that she had a webcam for using Skype.

All of the teachers worked closely with the technology experts, either at the school level if available, or at the district level. Abby called her “tech guy” to get websites unblocked when

she encountered a teachable moment and needed access to a blocked website. Bati said that she imagines what she wants to do, and her technology person helps her make it happen. Jokingly, Bati referred to her school's technology contact as her "dealer" because he would get her hooked on a new technology at school and then she would want to have it in her personal life too.

The study participants sought out places to network with other teachers to get ideas, even beyond the walls of their schools. Abby used email to collaborate on ideas for ways to incorporate technology. She did this collaboration with teachers from other schools and even outside of her school district, because "I probably collaborate more with, as far as what I'm doing, with other gifted teachers than regular classroom teachers. I collaborate with them as far as what they're doing, like giving them resources." Lettie worked on her school district's technology team that met regularly to determine technology policies for the entire system. Both Lettie and Bati used the educational social networking site, Edmodo, to connect with other teachers. Lettie said that her system had a group of "friends" on the social network so that teachers could post technical problems and someone would answer within a few minutes. Sometimes the networking was done to provide support in teaching students how to use technology. Bati had a few teachers, both from her school and outside of it that she worked with to anonymously read students' blog posts while she was teaching students appropriate online behavior when blogging. Lettie helped other teachers gain technology skills by having the teachers who were technology-weak watch teachers who were technology-strong use equipment such as the SMART Board.

The love of technology that the participants expressed was evident in their teaching and in their interaction with the students. Whitney commented during the interview that her students knew that they were going to do activities with technology because they knew that she loved

technology. The participants showed a willingness to try both new ways of using old technology and new technologies in general. When it came to students having personal technology at school, Bati expressed, “I really am an advocate for, instead of the whole cell phone thing, ‘you can’t have it,’ why don’t we utilize it in a positive way?” The participants also had an enthusiasm for helping others. They were willing to help train and trouble-shoot with other teachers. The participant teachers also provided resources for other teachers. For example, Emilia gave the teachers of her school sheets with education appropriate website links and provided in-service trainings at her school. Both Lettie and Abby collaborated with the teachers at their schools to provide technology mini-lessons for children who were not receiving G/T services in their classroom. Kayla regularly helped other teachers on her hallway when the school’s technology person was unavailable. All of the teachers had been approached for help with technology by other teachers at their schools, even if they were not the designated technology expert at their school. However, according to the participants, most of the time they were assisting with setting up or working technology equipment or programs and not in providing help with implementing technology with students. The G/T teachers in the study had a certain level of expertise upon which they could draw when dealing with educational technology.

Expertise

Research demonstrates that the amount of the teachers’ in-service training and general comfort level with technology influences the specific technologies teachers use with students (Shaunessy, 2003, 2007). The G/T teachers’ expertise with technology was evident in several ways. This expertise was created through time spent using technology and time spent teaching with technology. They had a level of fluency that allowed them to support the technology use of students and fellow teachers, as well as aided the G/T teachers in planning how to use

technology with students and anticipate potential issues. Teachers both used technology personally and in their professional life.

The technology teaching experiences of the teachers in the student varied. Their teaching varied from Abby, who explained, “Like I said, I hadn’t really taught before there was technology in education” to Emilia, who commented, “I mean, really, technology’s changed my whole way of teaching.”

Experience helps teachers know what is available for their use. They are likely to use technology frequently. Interview comments included,

Lettie: It’s very hard for me to think of a time, a single time, where we just absolutely do not use technology in some form.

Abby: Now the kids are not necessarily always using it [technology], but it’s probably rare that they would come in one day and not use something.

Emilia had developed a list of websites that she had given to the teachers at her school. She shared this list of Web 2.0 technologies during an observation, and she had ideas for how to use these websites in her classroom; such as using Blabberize for students to create reports about famous people, or using Wordlywise to help develop students’ vocabulary. Bati had been actively experimenting with Google docs and for the first time had used it to go completely paperless for her interest-based enrichment projects for over 100 children at her school. Kayla and Abby mentioned online presentation programs that could be used to go beyond what was possible in a PowerPoint presentation. Whitney knew through experience that the quickest way to find child-friendly websites was to include the term “for kids” when searching a topic on Google.

Experience also helped the teachers understand ways to use technology in the classroom. Lettie was learning to use the SMART Board or Netbooks as a center in her classroom. Personal experience can grow into ways to use technology in the classroom. Lettie said,

I would not have thought about, per say, Netbooks in the classroom at a center, because you're just so used to seeing desktops. Until I had one of my own, and I think, well you know what, my kids could use that, and they could sit in a center, it wouldn't take up as much room, and they could really go anywhere in the classroom that they're comfortable and sit down and do their work just like if I let them go anywhere and read a book. And they're cheaper. So you're able to, you know, get more, and use them. If I hadn't used it at home I probably wouldn't have known that. I wouldn't have known how easy it was.

Emilia wanted to try having her students do online book reports because her step-son had done one at his school. Abby, Emilia, and Lettie had each learned over time that when using blogging with students that the students need to be trained in how to appropriately blog with each other and that prompts were the best ways to elicit the specific behaviors they wanted from the students. At least two of the teachers had experiences with word of a death associated with someone at their school spreading via email or a social network, and they made adjustments in their technology use due to these experiences. Abby chose not to use Facebook, and Bati chose to have a personal Facebook account with no contacts who were students or parents. Bati did have a separate Twitter account for her class, and she used Edmodo with her students, but she kept her social contacts separated according to her personal life and professional life.

The participants primarily thought that in-service trainings should be done with hands-on portions for the teachers. Abby explained,

I think that if it is an in-service day, I think it's more effective if it's on one certain topic, or one certain piece of technology. And maybe part of the day is spent on how to use it, and the other part of the day is letting teachers actually use it to create something they are going to use in their classroom, rather than a day of presenting ten different things and here's a quick you use it.

The particular experiences that teachers had had developed their understanding of how to teach with technology. Their experiences were created both through avenues that influenced what technologies they chose to use and in opportune experiences that created teach-able moments that helped the participants understand what to do and what not to do when using technology with students.

Influence

In the context of this research, the term influence refers to what factors compel the teacher to use specific educational technologies in her classroom. Every participant teacher had attended conferences and specifically attended training sessions with exposure to different ways to use developing technologies in classrooms. Bati explained, "Any opportunity I get to go learn, I go learn." For Abby and Bati, their district technology experts were individuals in a position specifically for aiding teachers with technology. Some school systems had a teacher at each school designated as the technology leader. Lettie serves in this position at her school and had been involved with system-wide meetings to determine the technology policies for her school district. During the interview, comments illustrating the importance of in-services and other training included:

Emilia: I search it out on my own. Now, here at my school I have someone that I can go to. But if she retires I don't know what we're going to do

Emilia: You know, so, I think that technology can be utilized a lot more, but you have to train

Lettie: So, we have somebody who's showing us how it can be used, and then, "Oh yeah--I like that," and start using it and then it'll catch on. You know, one teacher starts from SMART Board in her class and then, slowly, everybody's like, "Oh yeah, I think I can do that." Then they all have one. Or, in the case of the school I'm at right now, a couple of teachers liked it, the principal liked it and she said, "It's something that's going to benefit our kids; we all need to learn it."

Whitney: I really think once teachers see how they can use it in a classroom they're more apt to try it. And so, in-services or summer workshops, you know, we went to a workshop in Mobile this summer and did some things with technology and it was amazing. You know, it makes you excited to come back and try some stuff.

All of the teachers believed that in-services should be hands-on and include as much possible time spent practicing with using the technology to plan ways that it might be used with students.

Lettie shared that in her school system,

...in fact, it wasn't catching on quite as much in all the classrooms as they liked, so last year ... the administrators did technology. And so, county-wide we had a focus each month. You know, like, Technology for Communication, Technology Literacy, the different, you know, like, Internet Safety.

The teachers were influenced by what current trends in technology were. Teachers' comments included:

Lettie: I guess you have to say to a certain extent whatever the trend is, because that's what's out there for you to see. I probably wouldn't have just gone out there and gotten an iPad. But,

you saw it on TV, you heard the kids talking about it, so, you know, I bought one to see what it was about.

Whitney: ...but I want to whatever that's something that's new and interesting I'd love to talk about it with my kids, even like a share day where they have things, I'm sure, they could tell me about technology. I know they could.

Whitney, after being exposed to and hearing about QR codes, wanted to insert one in her parent newsletter so that parents could scan it, and it would take them directly to whatever the class was doing. Bati talked about learning how use the QR codes to place on trees and plants outside to link to information about the plants, and Emilia liked how a teacher how put QR codes on books in the library so that students could read book critiques written by other students.

The participants also were persuaded to use technologies that made their life easier.

Examples of participants' comments about why they used technology to make their life easier included:

Bati: Well, like record-wise and statistic-wise, I can do all of that online now. I can keep up, you know, for my purposes all of those things. [Discussing paperwork from her individual enrichment projects]

Bati: And I could manage it from home. I normally would stay up there til ten or eleven at night, but I could bring it home and do it, you know, see it on my computer form home and manage it.

Lettie: I would also say whatever seems to be easy for me. I have this little Netbook that I'm using right now that I love because it fits in my purse. I got it for school.

Emilia: I went and bought an external harddrive at the beginning of the summer. Because I was like, I've got to keep everything because my USBs were breaking. I was losing things and so my, I'd just put it in my purse and just carry it everywhere.

Emilia: I will look at Promethian Planet for lessons, but I like the SMART Exchange. I think it's easier, more friendlier, for me, at least.

Whitney: We've had a class Wiki before and that was the way, that's my favorite way to assess them because in class they would put things on the Wiki instead of taking home a whole binder full of things to grade I could just get online and click on their name, and check it, you know, and I love that

In Abby's classroom, if she encountered a teachable moment while she was sitting in a circle talking with the students, she used her iPad to look up information. The iPad was more convenient than having to wait for a desktop computer to boot and then having to talk a student through finding the information or trying to look up the information or a video clip later, when the teachable moment was long past. Instead, she said, "It's like, oh I can go to the iPad, look it up, here's the answer right here. Or, here's a quick video clip right here."

Teachers sometimes could see how technologies from their personal lives could be used in the classroom. Lettie's personal Netbook helped her see how she could use it for learning centers in her classroom. More often than not, participants learned to use something in the context of the classroom and then took it home. Abby bought an iPad after using one in her classroom. Whitney learned about the QR codes at a conferences and "I came home to my husband and said I wonder how we can use this at home, like put them on storage boxes, that kind of thing."

Lettie summed up the relationship between technology, ease, and whether the participants were likely to use certain technologies. She said, “I guess some of it’s just a matter of does it make things more convenient for me?”

Opportunity

Stories shared in the interview data and events that occurred during the observations demonstrated that there are unplanned-for events that occur with technology. Teachers may experience these events in either a personal capacity or with students, but regardless the experience influences the teacher’s planning for and implementation of educational technology. When the opportunity presented itself, the teachers reflected on the unfortunate event and used it to inform future decisions.

Some of the participants had made blunders in using educational technology with students. Kayla’s computer at her desk was the one connected to her projector, and her email was set up to provide desktop reminders when a new email arrived. During one observation she had an email arrive in her inbox about a personal matter for another teacher. Even though the desktop reminder only contained part of the title of the email, Kayla quickly moved to dismiss it before the students could read it, and she commented that she had not thought before about turning that feature off while using the projector. Abby learned from past dealings with parents that, while email was a great way to communicate with the parents of her own students, any parent she did not know well it was better to call than to communicate via email. Abby also told a story, “This year, I was trying to get a model of the human body. And I typed in Google ‘model body.’ And what do I get? Victoria’s Secret models. What was I thinking?” Whitney had had similar experiences with finding images using Google. She explained,

I'll tell you. I like, like when I'm searching something on Google and I want an image of something, I like to get on images, but I always try to, I don't like to do that on the big screen because if the kids see it. I mean, you didn't catch a lot of stuff, and there's inappropriate things will pop up out of nowhere, and that always makes me nervous, so when we're looking for images for something, I'm like, "Okay, let Ms. X look on her computer first."

Abby also learned a lot from the first time that she decided to have her students write a blog with each other. She shared,

I learned that the hard way about blogging with each other....This was my fault. The first time that I used blogging in my classroom was, going on four years now, I guess, with the last presidential election. We did this huge election unit, I mean we tracked it for like two years, like before the primaries started, we'd been tracking, so, the same thing as [Bati]. I'd give them a prompt. It was a political topic.... Probably wouldn't start with a political topic for the first blogging experience... And so it just got out of hand with it. I mean, they weren't being rude to each other, it was really more silly. It was probably the first time they had had the opportunity to do that in the school setting.

Bati had several learning experiences with technology in the context of her enrichment projects. Students had created products based on individual interests and were to share the products using computers. The community was invited to the fair to see what the students had created. Bati emphasizes that all of the work is supposed to be done by the students by themselves. She explained,

One thing I had to, to learn, I thought that it might happen but I wasn't positive that it would happen, that when I opened up to my [enrichment] being 100% online, is that I

took a risk that a parent could get involved and do portions of it that I did not know.

Because normally none of the [enrichment] stuff goes home, they do every bit of it at school...But we can control it at school. And I knew that it was a possibility and it did happen.

During the creation process one of the student's parents did some of his work. She knew that the parent was doing the work because one morning the child was sitting right in front of her during her morning duty time and a blog post from him appeared. Furthermore, he brought a memory stick from home, which she does not allow, that had more work completed than what it should have had.

Because I had worked with this child before, he would have been fine on his own. And he did, for his ability; he did the right work he should have. They're one of those that took over and did it for him....And he could not, we would not accept a blog from him at home anymore, because he had time in class to do it.

Additionally, she had a learning experience from a power outage.

Because last year, the, probably two hours before it, all the power went out. And it shut all of their computers down, over a hundred computers. And the kids had gone home to get dressed, and look nice, and they called me and I was in the shower, so I went back up there with my wet head, and we were just dink, dink, dink, turning them on. And fortunately there's teacher friends there that knew I was in panic mode. And before I got there were already booting them up, getting them ready to go....This year I took that as a learning thing and we had a backup plan. If it happens, that's part of technology, you still stand at your area and talk about it and be a pro and be an expert on your topic. But we

have to have a back-up plan now. Didn't take that happening but once to have a Plan B ready just in case.

Kayla regularly reminded her students to save their work. She talked about having a student who was almost completely done with a brochure and someone accidentally bumped the power switch on the computer. The student had not saved her work and had to start over. During one of the observations with Kayla one of the computers froze and required a forced shut-down. Fortunately, the student had saved her work and was able to recover most of what she had done. Comments that were typical of how the teachers' long-term experience with dealing with the technology problems included,

Emilia: If they [technology equipment] don't work sometimes, then you have to have a back-up plan. But every good teacher's going to have a back-up plan anyway. Hopefully. You know, batteries go dead, things go out. And that's a drawback. But you problem solve. "What do I do next?"

Whitney: Over the years I have learned, you know, some more tricks, how you can turn everything off or disconnect things, but I do, I get so frustrated, because you know, you have this great lesson and you really wanted to see it and it just kills so much time when something doesn't work.

Whitney: ...it's not always a hundred percent fool-proof and it can slow. I feel like sometimes it can be eating up a lot of time, but I think, as a good teacher, you've just got to be able to read that and have an extra activity handy, or, you know, say "Hey, well it didn't work out this week—we'll try it next week."

Whitney mentioned that she always has a logic worksheet handy for the students for those times when she needed to spend time trouble shooting technical issues. She does this “So they’re not just sitting there doing nothing, because that bugs me when they’re not on task.”

Equipment

Equipment could mean both the hardware and software used in the G/T classrooms. Equipment issues were interwoven throughout the codes funding, assets, resources or tools, and purpose or accuracy. The equipment available for teachers and students to use influenced the activities they were able to do. Equipment to which teachers had access to and training with was influenced by monetary decisions made by the school district, decisions made about the ways equipment was divvied up at each school, and the functionality of the equipment. School district and individual school funding affected the condition of the equipment, as well as to whether the equipment could be counted as assets by the teacher. The availability of equipment was discussed in terms of technology assets, which was mediated by how the equipment was partitioned among school personnel and any constraints of the equipment that influenced teacher use. The functionality of the equipment was found to influence the purpose behind why certain technology was utilized, and how the technology functioned as a resource or tool for the teachers and students.

Funding

The term funding refers to how availability of school district or school level money determined what equipment and what quantity of units were purchased. Although teachers desired equipment to which they had no access and worked actively to find additional funding to purchase it, they used what was already available to them when making instructional decisions

for students. The lesson plans and the observed lessons used the technology that was already available to the teachers.

All of the teachers expressed interest in new equipment, but they were not all at schools that currently could afford to buy new equipment. Bati and Abby mentioned that new teachers are used to teaching with technology, but as Abby said, “They’re fine starting with technology, but what would you do if you go somewhere that doesn’t have it?” Emilia mentioned that she had just completed writing a grant application for buying an iPad for her classroom, and Whitney expressed interest in a grant to purchase a classroom set of iPod touches. Lettie had won a grant the previous year to be able to buy graphing calculators. Most of the participants also supplemented their equipment by finding access to free programs; often online. Emilia was using the free portions of the Wordly Wise website because her school did not have funds for purchasing the full Wordly Wise program. Whitney said, “...you know, they had the free Wikis that you could make for education purposes, you know, free, I like free.”

Some of the participants were at schools that had more money to spend on technology than other schools had. Abby was in the fortunate position that if she wanted something her Parent Teacher Association would likely buy it for her. Kayla was able to supplement what was available to her by the fact that her students, who were from middle to high SES households, could afford to be required to bring their own memory stick or they could be asked to help bring in print cartridges for the classroom printer.

Some schools with more limited funds were not able to supplement what a teacher had if something was broken or stolen. Kayla had a digital camera stolen from her classroom, and the school was unable to replace it. Emilia was without her projector for at least a month because it

had been sent off to be fixed and the school did not have a replacement. When it came to broken equipment, Bati commented,

They [other teachers] probably don't use it [technology equipment] enough to understand it to begin with. And forever we've been told, "If you break it you're responsible for it."

So it just stays in the box, therefore it won't get broke

Funding also affects the teachers' access to technology experts. Both Kayla and Emilia worked at schools in which a dedicated classroom had housed the computer lab for the school. Each school had emptied the lab of computers, moved the educational technology teacher to another position, and offered a laptop cart that required check-out. In Emilia's case, she still had access to the computer teacher, but the access was more limited because the computer teacher was now the media specialist running the school library. Bati's school still had a dedicated educational technology teacher, but the school shared him with three other schools. Although Bati could call the computer teacher for help or have him remotely work on her computer, he only was physically present at her school one week out of every three weeks. Furthermore, Bati mentioned that funding cuts made it look like he would be stretched between four schools next year. Bati's comment was,

...if his week happens to fall on Christmas, then we won't see him at all in December. I think that's one of the reasons, like [Abby] and myself, we learn so much and learn how to troubleshoot ourselves, and then call. I don't abuse that privilege at all with him, and I think he appreciates that.

Funding also influences how up to date the equipment is at a particular school. The schools have had awhile to collect technology. All of the schools had a mix of desktop

computers and either laptops or Netbooks. Various other technologies were available. Bati mentioned, that “Cameras. Any type of camera you would want” were available at her school.

Timeliness

Timeliness was defined as how up to date the technology was that the teachers were using, as well as their sense or the students’ sense of whether they were using older or newer types of technology. All schools had computers available (Institute of Education Sciences, 2010), but the degree to which they had other equipment such as digital cameras, iPads, SMART Boards, and other newer technologies varied.

Participants were interested in newer technologies and ways to use them in educational settings. Bati expressed her opinion,

And my biggest pet peeve, and I know it’s not everybody’s, there’s so much more that you can do than PowerPoint. And so many, so many teachers think that that is a good project, and to me that’s very outdated now. There’s so much more that you can do than a PowerPoint. That’s very basic.

Newer equipment may differ from older equipment in the processing speed and the ways in which users interact with the equipment. All of the participants said that children preferred certain computers over other computers due to the speed at which the computers worked. Kayla used the computers in her back storage room, but they were not the preferred computers because they tended to be slower and sometimes required forced shut-downs. Lettie’s school was being forced to update their computers to be able to access learning programs for struggling students.

How up to date the software is in the classrooms also varied. In Whitney’s and Kayla’s classrooms students had to navigate different versions of the software they were using. In Whitney’s room, even though she had already started to create her product, one of the students

changed which laptop she was using, because she wanted to use the program that looked and functioned exactly the same way as what Whitney was modeling on the projector. Furthermore, during their observations, both Whitney and Emilia had to deal with either error messages or software update messages that interrupted their lessons.

The available functionality of the equipment varies by age, as newer equipment is more likely to have features such as webcams and speakers built-in rather than as external equipment that requires a separate purchase. Additionally, newer equipment is likely to have overlapping functions with other equipment. Examples seen in the participants' classrooms were iPads playing music like an audio player, taking pictures like a digital camera, connecting to the Internet and creating files like a computer, and Bati had a teacher friend who "Plugs hers [an iPad] into our machine and watches TV up on the wall. It projects onto the wall. Like a TV show, just a regular TV show off of that thing." When asked about what the three most important things were to teach children about technology, Emilia commented,

You know, I used to think email, but I don't think email's where it is right now. I think there's other, you know, other forms, you know, the smart phone's just pretty much got it all. I mean, in the ideal world, if everybody could have something like that, because you've got Internet access. You've got, you know, your texting. Right now, I mean I think I'd have to go with something like that.

Abby had an iPad for her classroom, but it was a refurbished one so that it was older and did not have a camera. She wished for a webcam to be able to use Skype, but said, "The new ones that have a camera you could use for Skype. And that would be cool to kind of, move it around, have it with your little group."

Newer equipment is more likely to be portable compared to older equipment. Abby's use of the iPad to find information while sitting with her class during her circle talks, and Lettie and Emilia using the Netbooks as portable learning centers demonstrate the portability of newer equipment. However, the portability of newer equipment may also interfere with their connection speeds. Whitney commented that she missed her old school,

When we were at [her old school] I had a laptop lab with seventeen computers and I pretty much had unlimited access to it—if I wanted it, all I had to do was go get the laptops and make sure they were charged and I had twelve drops in my room so I can, even if they weren't working wirelessly, sometimes wireless is difficult to, and it slows the computers down, they aren't as fast when you have all twelve of them [plugged into the Ethernet]...but now the schools I'm at now, the most I have drops in one are four. And the wireless is not always great, it's slow, and that's been hard for me, and at one school I have the laptop labs and at one school I don't.

However, all of the teachers believed that technology was here to stay. Whitney said,

I think when my kids [her own personal children] are my age I think their kids will have, I mean like it'll be like everyone has your, has a notebook and pencil, I think everybody's going to have like an iPad. I mean, I'm sure it'll be something bigger and better.

Assets

The term "assets" describes technology and how available it was. The concept of assets was related to the ways in which equipment was partitioned at the individual schools and the constraints placed on the teachers due to their particular situations. The term assets was chosen because it is analogous with the way that the term is used in financial planning. Teachers had certain types of equipment available to them in different degrees. The total of what was available

to them constituted their technology bank. The lesson plans and observations were required to have some type of technology use with students, and therefore these data sources automatically had some specific equipment in them. However, the lesson plans and observations might include just a small portion of the technology available to the teachers.

The length of time the teacher had been at a school affected the assets available to them. Whitney was a new teacher at two schools after the transition from center based to school based G/T services. She was able to use laptops with which she was more familiar at one school, but the other school had Netbooks and she had not had time to learn how to comfortably use them yet. Additionally, Lettie had just started teaching at her current school at the beginning of the school year. She believed that she did not know her current students and their abilities well enough yet to determine if they were ready to try blogging. Bati, who had been at her current school for several years, still missed the Macintosh computers used at the school where she taught before. She said, "I wish we were on Macs. I came from a school-system that was Mac. And it's just so creative, the creativity that goes with it."

Technology assets may also vary for a teacher if they travel to different schools. For example, Whitney was able to do more hands-on, individualized lessons with the students at the school with the laptops, but more whole group lessons at the school with the Netbooks. The middle school to which Emilia traveled had not had Title I funds available to help purchase technology equipment. Therefore she perceived the level of technology at the middle school as being less than what was available at her elementary school. Emilia explained that on days when she traveled to the middle school "I take my laptop, I check out an overhead so I can present."

Most of the participants had similar levels of technology in their classrooms compared to other classrooms at their school. However, in Kayla's classroom she had less technology

available to her as her classroom did not have a SMART Board. Kayla had equipment physically present in her room, but she explained her technology situation,

We supposedly are full force technology, and we do have computers in all of the rooms.

But they don't work very well. I have two out here; I had a third one and it died. I have

three back there but one has died, in the backroom, and they're constantly shutting down.

Abby had access to slightly more technology than other teachers at her school. She had a broadcast room attached to her classroom. The equipment in the broadcast room had been purchased from a different funding source than the general school budget. Abby said,

Like, the kids weren't really using the Mac for broadcast. And so I asked if I could just move it to my classroom, and he was like, "Only if you will promise me your kids will learn how to use the video stuff."

Since the broadcast room was attached to classroom, she did not end up moving the equipment, but just opened the door to the broadcast room when she had students who need to use that computer. Abby also had classroom funds through her parent teacher association that allowed her to purchase other equipment. The Lego robotic equipment was purchased specifically by her for her classroom. Therefore the robots were not used by any other teacher. She also used her classroom funds to purchase the refurbished iPad. Abby's technology specialist was surprised she bought it for the students to use. She did have to go through the technology specialist to buy apps for the iPad, but "It was no problem. He bought me an Apple gift card and I bought apps."

The nature of the learning activities in the G/T classrooms might mean that each individual student might all need a computer at the same time. Thus, even though most of the participants' classrooms had similar levels of technology compared to other classrooms at their schools, the level might not meet their particular needs. Kayla commented, "When you only have

a handful of computers you have to team up.” Bati’s school still had a room that was a designated computer lab. However, teachers were assigned times on a weekly basis and since she was not a homeroom teacher Bati did not have a regular time. She said,

And nothing makes me madder than, I just don’t have enough, because our kids want to use it and they can use it. And the computer lab’s across from my room with thirty-five beautiful fabulous computers, but I don’t have a computer slot for my children to go over there.

Even though the robotics units were designed as group lessons, Abby stated that she needed to buy more robots to be able to allow all of the students to be involved in the most beneficial ways. Abby expressed that other teachers at her school do not understand her need for more computers,

But even when it comes to doing research, it always seems to fall that they’re all needing to do research at the same time, and it’s hard for other people to understand, well you only have eight or ten kids, why do you need more computers? But I’m like, they all need them at the same time.

Whitney had an iPad, but only one. She said,

I do have one student that’s identified gifted that I go into her room and do things with her. Now she could use the iPad because it’s just her and I, you know, we could do some things with that.

She had not used it with most of her classes because she was still considering ideas about fair ways to allow large numbers of students to use the single piece of equipment.

The technology specialist could also be considered part of the assets available to the teachers. Abby was envious of the types of services Bati’s technology specialist provided. Bati’s

technology educator would not only trouble shoot equipment problems, but she explained, "... he does as much as he can to go in and teach and really he doesn't teach, he facilitates and models." Abby's technology specialist did not work directly with students, but instead trained the teachers so that the teachers could work with the students. Abby said, "...they call their technology person a tech coach, and he actually comes in and helps the kids. I really like that, having that available."

The assets available to the teachers included not only the equipment they physically had at their schools or the software programs installed on their particular computers, but also what Web 2.0 technologies or other web-based programs the teachers could access over the Internet. All of the teachers had used the Internet to have student research topics. Emilia found many programs and lessons to use with her SMART Board using a website called SMART Exchange. Abby and Bati had school managed portals for publishing student websites. Abby's school also automatically created email accounts for the students through Gmail. Additionally, Abby used the web-based *Stock Market Game* as a unit with her classes. Kayla's yearbook program was a completely online program that allowed students to design the yearbook from any computer with Internet access. However, some websites and services may be blocked by school districts.

Constraints

Constraints were the factors that created boundaries for G/T teachers' technology use. Some of the constraints were due to the equipment itself; others were factors such as the amount of time spent with the students. Constraints were frequently issues over which teachers had little or no control, but which impacted the students' experience with technology.

Sometimes the policies the school district set influenced what teachers could do. An example of a positive change that a school district made can be found in Lettie's district. Lettie

shared about how her district had changed their acceptable use policy for students accessing the Internet. She said,

...we had several, there were lots of complaints because people wouldn't read that and pay attention to it, and sign it, you know, they may be reading it, we weren't getting many back signed, and then there would be a problem when the kid went home and said, well Ms. [Lettie] wouldn't let me blog today because I didn't have my form back signed. Well then the parents would be upset. Well they do it at home, why can't they do it at school? Well you didn't sign the form.

The solution that her district technology team developed was to change the policy so that parents signed it if they did not want their students accessing the Internet, and if parents did not sign it the assumption was that the parents gave permission for the students to participate.

On the negative side, all of the participants expressed some frustration with websites and web services that had been blocked by their school districts. All of the participants believed their school districts were too restrictive about what was blocked. YouTube is a website that most of the participants said was blocked at their schools, but yet they desired to have access to it at school. Examples of what they said included,

Emilia: But that has so many resources to bring in to the kids that isn't on Teacher Tube and we don't have access to it at school.

Kayla: We have a lot of block. A lot of YouTube block. So it's, if there's something I want to show them about that problem that I had, the problem of the day, I wouldn't be able to pull it up.

Whitney: Or Youtube, but most of the time the county blocks Youtube, but we did find one website where it was, you know, we were doing the *Black Beauty*, and it was other

movies that you could compare *Black Beauty* to. And it had a little snippet of, like, some Secretariat, and it was really good, and the kids enjoyed watching that. And it didn't block that, so I like the videos

YouTube was not the only blocked site that caused frustration. Any time teachers found a website that was blocked and they wanted to use, they might react like Abby, who said, "No, they're pretty restrictive. Because sometimes there's things I go to and I'm like 'Why is this blocked?'" or like Whitney, who said, "There's been many a time when I've tried to pull something up that's blocked, and I was like 'You've got to be kidding me—I really need this.'" It may be that a site will work on one computer but not another. Whitney said,

I've noticed that- like some computers I can get on just about anything I want, but it'll say something's blocked, and I'm like "Oh no, I've got to undo this." Because I'll need, you know, to print something out, or get to a certain site.

If the teacher is planning ahead for a lesson, she could have the website unblocked; however, Abby explained that she was not able to unblock websites herself, but that she had to call her district level technology person. If the website was needed right away such as for topics related to a teachable moment, teachers either found a different website to use, or called the technology person to have it unblocked immediately. Additionally, sometimes it was not the school district blocking the website, but that the website had disappeared all together. The previous year Abby used a video from a university to show the students an example of a robot that detected fish; however, this year that video was gone.

Limited pieces of equipment shaped some of what the teachers were able to do. Bati explained that,

And this year the kids learned how to do a really good job with Movie Maker, and utilize, you know, and I was this summer trying all those other programs that I couldn't work.

Premier Elements, all those things. But I do wish- it came down several times to a situation where I wish we had one of the burners that will burn like fifty at a time instead of just out of one burn, one burn, one burn. [She made the hand motions of moving CD-Roms in and out of a drive.]

Many pedagogical decisions were made to cope with limited equipment. Students in Kayla's class usually worked in partners because of a limited number of computers. Emilia most frequently had her students rotate through various technology related learning centers, as well as more traditional centers just so that each student could have his or her hands on the equipment for at least a short amount of time. Whitney commented,

I have some other teachers at one of my schools that like to use the computers a lot, so I went from having the computers for a two hour block to just a one hour block, which was okay. I could still use them but I had to plan accordingly, to think, I've only got this amount of time so I need to, you know, really have our procedures set

Time constraints also factored into what the teachers did with their students. Emilia explained that part of the reason she used learning centers so much was because,

I mean, three hours, you don't have a lot of time. And kids work at different levels. And if I put a time restraint on it they can get it done. They know we have to have this done within this time period; we're moving on.

Bati assigned what she called "home fun" so that students were supposed to do their research about their Alabama animal at home and then they could work on the product during the enrichment class time. Abby had the students write in their design journals for their Lego robots

where to start the next time so that they would not waste time trying to remember what they had been working on the previous week. The students working on researching companies for the *Stock Market Game* lesson that Abby began during the second observation worked diligently during the entire lesson, but none of the students actually had invested in any company by the end of the lesson time. Emilia shared a story about the time issues the teachers faced in working with the pullout enrichment classes,

I was just talking to a teacher going, “How am I going to make them write?” and I’m like “Well you can’t put them on the computer because that takes too long because they don’t know the keys.” I mean, you want them to, and a lot of times, sometimes they will, like they’ll write the story and then they can go and put it in. It’s a pullout program three hours a week, so it’s, it’s not easy. You have to utilize your time.

The limited time teachers had contact with students was further shortened by other factors. All of the teachers, except for Lettie who saw students for an even shorter amount of time, worked on other lessons and projects with the students beyond whatever they were currently doing that involved technology. Other learning activities included problems of the day to promote critical thinking, work on other creative projects not using technology, debriefing, and times to address the affective needs of the students. Whitney summed it up in this way,

We just have so many things. We only have three hours with the kids, and we have so many things that we have to do. I like to do the computers first, though, you know, because that, they’re anticipating it and wanting to do it, but I like to go there first. And a lot of times I kind of use the computer maybe as the knowledge portion, you know, they get the facts and that kind of thing, and then later we take that information and apply it, or compare it, or whatever we’re going to do in the classroom.

All of the technology lessons observed were a part of larger projects that extended over several classes. Kayla's lesson with creating press passes was the only one where the students were both introduced to the program Publisher and then they also began and finished their product in one class time. However, her press pass lesson was also a small part of the bigger project of making a school newspaper.

The teacher's own level of knowledge or access to an expert acted as a constraint. The participants sometimes needed help from the technology expert for their school, but if that person only came periodically to the school then the teacher would either have to contact the expert and wait for a reply, or would have to try and solve the problem by herself. Abby admitted that she probably did not seek out new technology as much as she should. Bati commented that she believed that some of the other teachers in her school did not use the computer lab as effectively now that there was not a technology educator in the lab full time. Some of the teachers expressed interest in technology that was new to them, but they believed they needed to learn about it first. Emilia said,

But there is more I would like to push them to do. And be able to. Like I would like have a webcam to start the Skyping, to use, and the microphone. But those are things I've got to learn to do.

Kayla invited a representative from the online yearbook program she uses to talk to one of her classes; however the representative was not able to visit the other class so Kayla was the one to introduce the students to the program. Whitney had tried using the Netbooks at one of her schools, but she could not get the equipment to connect to the school's wireless Internet.

Whitney explained,

like these Netbooks, that's on my to do list. There's a man at one of my schools that is their technology coordinator, but he's a faculty member. And so I'm going to ask him, you know, how can, how can you help me with these? ...

She needed to find time to talk with the technology expert at that school before she was going to be able to use those Netbooks with students.

Partitioning

Partitioning refers to how technology was distributed in the school. The way that the technology is distributed affects the technology assets a teacher has. Some equipment belonged with an individual teacher in her room. As long as it worked, it was available to the teacher all of the time. In the case of some equipment however, the teachers were only partial shareholders. The equipment was purchased for the entire school and available for check-out. If other teachers at the school did not exercise their shareholder rights, then the G/T teacher was able to check it out and keep it in her room. However, if the equipment was in high demand, then the G/T teacher's use was limited by availability. There were also some types of equipment that the teacher had in her room, but in insufficient quantities for her needs.

The specific equipment available to the teachers sometimes belonged with their particular classrooms, but some equipment belonged to the whole school and required the individual teacher to check it out for a period of time. At Emilia's school the availability of technology was different from classroom to classroom. She explained, "We are a Title I school. We do have a good bit of technology. Everybody has overheads except for our kindergarten, and everybody, second through fifth grade, has SMART Boards in their room." Her school had gradually been putting SMART Boards in all of the classrooms by purchasing a certain number of them over multiple years. Emilia was one of the teachers who received her SMART Board the first year

purchasing was done, so that she had had her board for two years and was able to be a leader in ways to use it.

Equipment available for checkout required preplanning to sign up for it. Whitney said, “I would like to have more access, you know, to technology that actually stays in my room, other than the whole checkout process.” For Whitney, differences in access to equipment at the two schools where she teaches students caused her to have to change the delivery format for her lessons between the schools. There was also a difference in the demand for the equipment by other teachers at each of the schools. Whitney explained,

I’ll put something on the Wiki and the kids all go on it. We’ll do that on Monday and Tuesday, and I’ll be like “This is great,” and then on Wednesday and Thursday I have to, you know, model it for the whole class with the laptop, with the one laptop I have, that’s hooked up to the LCD, so they can still see the websites

Emilia explained that she disliked the equipment for checkout because the equipment was often not charged, and she therefore had students complaining when the batteries went dead on their computers.

Sometimes teachers were able to supplement their own classroom equipment with other equipment at the school. Both Abby and Kayla were friends with the librarians at their schools and were able to send students to the library to work on the computers there. They were both friends with the media specialists at their particular schools, and they knew that students would not only be able to work on the computers in the libraries, but that the media specialist would also assist the students if needed.

A few of the schools had transitioned from computer labs with classroom teachers having assigned times, to laptop or Netbook carts. Sometimes this change meant that rather than

technology specialists directing technology literacy for students, it became the responsibility of the classroom teacher. Kayla explained,

So by them, them meaning our administration, taking out our computer room, the lab, I really hate that. I liked it. Now some of the teachers didn't like it because, "Oh, we've got to do the computer this week." But little do they know, I mean, I realize they have to take their class in there, and. But the kids probably looked forward to that. It's like P.E. I mean, some kids look forward to P.E., and that's their out. They don't get it now.

There were also differences in the ways that the schools handled newer equipment. Some schools were able to have cart with multiple pieces of the new equipment. Whitney knew of several schools in her district that had iPad carts; including the school that had been where the centralized G/T program previously was located. However, due to the changes in the G/T services in her district she did not happen to teach students at schools where there were iPad carts. She said,

I do have access to iPads. I have an iPad 2 and just a regular iPad. And I've used them for myself; I haven't given them to the kids yet because I only have two of them, and I haven't quite decided how that's going to be fair, unless we do like centers or something,

Resources and Tools

Technology is a tool for completing other tasks. During interviews the participants said that they had occasionally taught lessons directly about technology; however, most of the educational technology use is embedded in the teaching of other content. All submitted lesson plans and observed lessons were learning activities where technology was used as a tool to aid in either learning other content or creating a product for another purpose besides technology. Interview data also suggested that teachers used technology to deliver content, create products to

measure learning, or create products to support other learning. The codes that were labeled with the name resources and tools were times when the teachers or students used technology to find information, create a product, or support learning.

The participants found many uses for the various functions of which technology was capable. Emilia, Whitney, Kayla and Abby either in their lesson plans or during their observations used video clips found online to supplement their lessons. Bati listed a video that not only supplemented her lesson, but also was about technology. Prior to her students beginning their fake Facebook pages for their Alabama animals, she planned to show a video titled *What is Social Media?*

The Internet became a source of finding lessons or ideas for lessons for some teachers. Whitney admitted,

I know, myself, I don't like to have to re-invent the wheel. So anytime I can share a lesson plan with another teacher, I love it. I love getting on the ALEX [Alabama Learning Exchange] website, and looking at databases, at lessons and stuff. I love that stuff

Emilia used online resources to find already designed lessons for her SMART Board. She said, "And I use SMART Exchange. I'm a SMART Exchange person for the SMART Board. I'm not a Promethian Planet. I will look at Promethian Planet for lessons, but I like the SMART Exchange."

Teachers approached educational technology in a variety of ways. Samples of the various ways that teachers wrote about using technology as a tool in their lesson plans included, Whitney: I want you to work with a partner and use the Internet to learn interesting facts about the Olympics. [Lesson plans, as well as the links, were found on her class Wiki.]

Lettie: Students will be using a SMART Board or Interwrite Pad to complete this activity.

Bati: The learner will use a variety of technologies to access, analyze, interpret, synthesize, apply, and communicate information.

Kayla: The students display their photographs to the other students in a slide show presentation. An overhead projector can be attached.

Emilia: Where in the world North America? SMART Board [A lesson for the SMART Board where students moved states to fit on the map of the United States.]

Abby: Using the Lego RCX build and program a robot that will detect fish as they swim by
All of the participants had used technology for research. Research was either done by the teacher to learn about a topic or by the students.

The ways the participants approached research with students varied. Examples of the various approaches included,

Whitney: I think it really helps with research, you know, I remember, you know, you used to get books out and do all this research. Now it's just so quick, you can Google it and it's there.

Abby: But you know, or sometimes if they're doing research, one thing I really stress is using Virtual Library as a starting point for research instead of Google. And that's a technology thing I do. Teach research skills.

Frequently, the teachers would provide their students with a list of websites to begin their research. The website links would be placed in a Word file saved on a shared drive, placed in a class Wiki, bookmarked, or shared in some other way. Teachers were concerned about finding student friendly websites. Whitney recommended using the phrase "for kids" when searching for websites. She gave an example for a recent unit her classes had done about animals,

But I just, you know, when I'm searching for things I really just try to type in, like I said, you know, I typed in, it's so funny, animal cruelty information for children. That came up with the ASPCA website, which is perfect because it's all written in kid-friendly language.

Technology could be used in helping assess student knowledge. Emilia had an electronic system called Eggspert that consisted of a control panel with six colored, egg-shaped buttons. The system functioned like on a television game show. She used it as a center to have students quiz each other. Lettie had used the AlphaSmarts system at her school. She explained it,

Those AlphaSmarts too, which is also a form of technology, those also work exceptionally well for having kids do things too. It's AlphaSmarts or NEO. We have some of those carts, and it literally is a keyboard with a little screen on it, the size of a calculator. And you can put like, you know, the questions you are asking me. You can have typed in there, and it will pop up one question at a time, and the kids type their response to it. And then click print, and it prints to a printer and there's their stuff.

All of the participants used technology for students to create projects, some of which were to demonstrate learning. Lettie, Abby, and Bati had all used blogging with their students. Whitney liked having the students create wikis. Lettie commented that students often had better thought out answers on blog posts than if they had just had a face-to-face discussion in class. Bati explained how her enrichment projects had changed over the years due to technology,

We do have days where the community can come in and just see what they've done. Well they went from big monster display boards, to everything is encompassed in their computer now... The kids went from using tri-fold boards and showing their displays to it's Glogsters and building their own wikis and we do- it's called Writeboard.

Kayla taught her students how to save pictures on the computer for later use. The pictures were part of a larger project that was the creation of either the yearbook or the newspaper. Additionally, Emilia used technology to address learning deficits at her school. During standardized testing the previous year, many of the students tested poorly in the areas of vocabulary and geography. Emilia found and shared with other teachers at her school web services related to vocabulary. She also was using videos and programs on the Internet to expose students to other cultures, as well as using technology resources to help them get a better sense of geography and geographic features. Emilia was using an educational program called *Material World* that was a resource from the Public Broadcasting System. She said,

Which is at the end we always ask the question, “What technology do you see in the picture?” Like in Bhutan, we’ve looked and it’s in the Himalayans, they don’t even have electricity. So the kids are able to see we really are fortunate of the things that we have. And then, like, they went back seven years later, and the tape of it and the material things that are important to them. And they have light bulbs in the front. So they’re able to see, oh, they’ve got lights! You know, so it’s really, you know, exposing them to other cultures and different things that are going on in the world. Because they all think that there’s Wal-mart around every corner. They don’t know what other, how other people live

Technology was also a tool that helped carry learning home. Lettie and Bati had students who wrote at home in response to their blog prompts. Bati had used another Web 2.0 service, My favorite, if you hadn’t done the Writeboard, because when the kids are at home, you know, we do it all the time in the middle of the night, when you have that “Oh, aha!”

moment, they just go straight to it and say, “Oh, I was just wondering what you think about them.” It’s fabulous. I love it. Writeboard. It’s fun.

Bati also used services such as Twitter and Edmodo with her students. Whitney said that she frequently had requests from parents for her to invite them to the class wiki.

Pedagogy

Pedagogy encompasses the decisions that teachers made that influenced students experience with technology. These decisions included both planned and spontaneous lesson features including issues such as whether there was flexibility in the lessons so that students had some autonomy, where scaffolding was present, presence of mini-lessons, subject matter with which the technology was integrated, the sequencing of instructional activities, and the hands-on practice time planned for students. Pedagogy was woven throughout the lesson plans, interviews, and observations. In terms of this study it is where there was an intersection of content, knowledge, and teaching using technology (Mishra & Koehlr, 2005).

Pedagogy codes traced teacher thinking about complexity in the learning tasks, deciding what topics to integrate with the technology, planning the sequence of instruction, determining pacing, creating practice and hands-on experiences with technology, scaffolding students’ learning, offering on-demand mini-lessons when needed, using mentors when appropriate, providing opportunities for cognition, and opportunities for students to diversify their learning.

The participants in the study indicated two different ways that they planned lessons using technology. One approach was to begin with the end product in mind and then plan the lessons necessary to lead up to that end product. The second approach was to begin with a topic and then

plan the lessons; letting the end product emerge from the development of the unit. Bati represented the first approach when she commented,

I guess I kind of teach backwards, because I have a big idea, “This is what I know I want everybody to accomplish this,” but even with bright kids they’ll be ten different ways to get to that end, and however they are most successful getting there is what we’ll do.

Whitney, who said, “I usually pick what I’m going to teach and then find technology to go with it” represented the second approach. The only teacher who said she sometimes started with the technology and then found the content for her lesson was Lettie. This was due to the fact that she had won a grant for a set of graphing calculators and she explained,

And so I’m going to have those. So I used it with Titanic before, but I started seeking things I could use that with. You know, “Am I... am I teaching something I could use this with?” When I’m thinking about math.

However, Lettie said that most of the time she would think “This is the subject matter. These are the technologies available. Now, what’s the best thing to use?”

Thus the technology was always merged with other content. Lettie summed it up by saying,

Well I think that an important thing is for it to be embedded in everything they do. Kind of like reading is embedded in every subject, some kind of way, because the more they use it, the better they’re going to be at it. So the more they’re exposed to it and see you using it, and the more they’re able to use it, the more they’re going to know about it.

When students used programs with which they were unlikely to be familiar, the teacher taught a lesson specifically about using that technology, followed by lessons that used the technology integrated with the desired topic. Lettie said that she had taught a separate lesson

about how to use the Excel software. She knew that students would not have used the program before, and she wanted to use it for them to keep track of imaginary expenditures for a unit. Abby explained, “I mean, it just depends on if we’re going to be using something that I know is new to them, then we’ll spend some time talking about how to use that.”

The participants gave time for students to explore new technologies. Kayla summed it up this way,

Especially at first. Because I don’t want, I’m not the type of teacher that says, “This is this. Now you know it. This is this. Now you know it.” I like to share some information, but then I want them to use their brains to search and gather new information. Like I said, they’ve shown me a lot about this program, that I didn’t know about. Because they explored. So I think exploration is very, very, very, very important, especially for the gifted kids. Because, like I said before, they’re smarter than me. And I don’t, I said “I’m just wiser. I just know where to find things.” But they, so I might, I don’t know everything, so with my telling them things, that’s limited. I believe that they, by exploring, they find a lot.

When planning with technology, the teachers wanted to create balance. The balance might be between working in groups or individually, as Kayla mentioned, “I do some group-work, and then some individual; it’s a balance. Because I think it’s important that they, I need to know if they understand it, so that’s why they have to do it by themselves a lot.” The balance might be between modes of learning activities. Emilia stated, “They’ll do some type of technology in one center, and then they’re going to do paper and pencil or they’re going to do a hands-on manipulate. So it just all depends.” The balance could be between the amount of direct instruction and exploration time. Abby related,

What's the funny thing about this robotics, is that, I eased into it slowly, but I went into it with the mindset that I'm just going to let them run with it. Because if I spent a whole day going through a tutorial of how to do this, this, this, this, and this, they would be tearing their hair out. And they would be so bored. You know what I'm saying?

In general the beliefs of the participants about planning lessons that involved technology was, as Bati said,

...the computer time needs to be utilized well, and benefit from it, because there's others of us that would kill for that time and they won't share. It's not a babysitter. The computer lab is not a babysitter. And it's often used [by other teachers at her school] as a teacher-break babysitter.

Pedagogy will be discussed in three broad sections within which the codes fit. The first section will address the characteristics of the teaching, the second section will address the content of the instruction, and the final section will address the learning activities in the teaching.

Characteristics of Teaching with Technology

The participants' use of educational technology in their classrooms was characterized by flexibility, on-demand teaching, scaffolding and mentoring. This section will address these three characteristics of teaching with technology as they appeared in the data.

All of the participants provided ways for the students to have some choice and independence in what they were doing. In Abby's robotics classes they had to work together due to a limited number of robots, but the students had freedom to decide the group in which they would participate. Furthermore, she did not assign them tasks once they were in their groups, but she allowed them to "decide who will work on building and who will work on programming." It was similar in her lesson about the *Stock Market Game*. For that unit the students could work

independently or in small groups of their choice. Allowing students to group gave them choices about what work to complete out of the task. Kayla explained that in her classroom, “Just about everything I provide for them, they can feel comfortable on their level. You know, so if they’re not real creative, they usually get with a creative person. If they’re more black-and-white, they do a this is this, this is this, this is what I want to say, and they let the person do the fluff. So it, in here, it’s very natural.”

Bati not only allowed her students a choice of the Alabama animal for the topic of their projects, but also in their Edmodo account each student had his or her own account and was given time to change the avatar that would represent them online. While many of the participants allowed students to choose a topic from within a limited domain, Bati’s enrichment projects provided the students with absolute freedom of choice of topics. She said, “...those are individualized to every kid. It’s not necessarily a topic, because it can be hundreds, but there is a process that leads the kids to a critical problem-solving unit- is really what it is.” She commented further that all of the students were at different levels, and due to the process she used for them to create their enrichment project, “...because they’re being taught through an interest and what they love, and it’s being differentiated for them. So that they can be successful. But they’re all successful at it, just at different levels.”

The participants did provide some differentiation according to ability level in the lessons, but the differentiation was mainly planned around the grade level in which the students were enrolled. Abby explained,

And this past year I’ve grouped third and fourth graders together, and fifth and sixth graders. So I had some, just because that’s what they chose, I had some common groups. Like there was third and fourth robotics, and there was fifth and sixth robotics. Because

everybody in [their G/T program] wanted to do that, basically. But there's differentiation between this, because actually the older kids were using a different program.

Lettie was able to use the AlphaSmarts in her classroom to have "Each working on something, at different levels, if they're writing on those things and then have it print. And then you can go around and talk to them each individually." However, some of the lack of planned differentiation may be due to the interests of the students or if the topic being taught is one that is brand new to the students. Abby shared an experience when she allowed students to choose their enrichment class based on personal interests,

And so, which sounds strange, there wasn't that much differentiation between third and sixth. And I mean in some of their final products there was. But when it came to learning the information, I mean, the third graders are just like sponges, they'll just take in as much as you'll give them. And the sixth graders' attention span probably wasn't quite as long. So that kind of worked out. But obviously the things I asked them to do with the information were different.

As far as the level of the content, most of the participants indicated that students should start with the content provided by the teacher, but students were then allowed to find other resources on their own. The participants explained,

Abby: They pretty much always have a choice. If I'm giving them, if they don't have a choice it's because there's a very specific something that I want them to find out or do. Which, that would be the exception rather than the rule.

Lettie: It's my personality to give them lots of freedom. Now, I might give them two or three websites that are really good and have really good information and say, okay, this is a starting point. But I don't usually limit it and structure it that much where they can only

go there, they can only do these things. And if it's a product, a lot of times I would get, you know, if we did tic-tac-toes with different activities, well I would have different products that they could use using the computer.

Bati: But I, for me, the better thing to do was to post a prompt for them instead of just turning them loose. And so they had to answer their prompt, but if there was something else they wanted to discuss they could do that as well.

While there were moments in the observations when teachers may have taught students something they needed right at the moment, it was through the discussions that took place in the interviews that the code of on-demand emerged. The theme of on-demand is defined as when the participants taught a mini-lesson just as it was needed for some larger project on which they were working. While on-demand mini-lessons were a form of support for students' technology use, they were also a feature that characterized the participants' use of educational technology with students.

Some of the participants had used contact with a mentor to foster an interest. Finding and communicating with mentors usually involved using some form of technology. Abby regularly accessed information online from the University of Alabama-Birmingham website. She said,

...one component of that is they have to contact a professional. So we talk about how to find professionals and we use a lot of university websites. I start with UAB always because I find them very helpful. And then if they, if I can't find something on the UAB website we'll branch off in the country.

Bati used mentor relationships with the students when she did the individual enrichment projects. Sometimes the mentors were from the surrounding community, but technology extended the available pool of mentors. She shared,

I am getting better results because it's immediate response, from the professionals in the community. And we're, we talked to people all over the world. And they are, kids are getting immediate feedback and responses, so there's not that lag time. ..My favorite thing this year, is obviously I look at a lot of Renzulli's stuff. And the student that I told you about actually called Renzulli and talked to him this year and told him he was interested in his stuff, but that his teacher had told him "You can't take somebody else's work," but could he have permission to change some of his little, some of his ideas to make them better for his classroom. And Renzulli wrote him back and said of course, absolutely, if you'll share your findings with me, and all that kind of stuff.

Sometimes the mentors were not for just an individual child, but for a group of children with similar interests. Lettie told about an experience at her previous school,

They were, you know, dabbling in programming and creating video games and that sort of thing. I used Skype last year with SMU in Texas and they, their professors were able to talk to my kids like you and I are about the video game development industry and where it's going, so, if they were interested in it, what they needed to do, some programs they could use to start designing their own video games.

As students learned how to communicate with a mentor, some of the participants found that they had to teach the students about how to effectively and respectfully communicate. Abby mentioned,

What I do, is I, they'll send an email from my school account and they'll say, so I just have to coach them up on what to say. Because they'll start an email, here are my ten questions. Wow, wow, wow. Let's back it up, you know. We'll talk about introducing

yourself, and what is your purpose, and how did you find this person, and how can they get back to you. So, there's definitely some education there.

There were other lessons that the participants did on-demand as problems were encountered or skills needed. Sometimes the skills were related to being able to use certain features in technology. Emilia shared,

Because just like when we were learning about QR codes, they didn't know what it was. And so we actually went in to the QR generator, made a QR code, and then I took my phone and showed them how. And I went through the step of, download an app, you have to have that. And then we actually pulled it up and then I showed each one my phone on how it was. So, you know, as it comes up I try to show them

Emilia commented that for figuring out some things with technology that "We have to look at it together." Kayla built into her lesson plan, that with inserting text boxes, "Some experimenting may be necessary with this step" for where she and the students would work together to figure it out on the spot. Lettie shared how she approached when something comes up that a student needs to learn right then,

You know, if there's a glitch in something, then we'll just go, I find some kind of diversion, you know, this happened, let's- A lot of times, if it's my higher group, ... okay we have lost Internet power, let's figure out why. And, kind of, troubleshoot together, and let them see me going through the processes, so that they can, in turn, do that later.

You know, let's check the cords on the back.

Lettie provided impromptu lessons when she realized that there were certain skills students needed. She elaborated,

And one day I went and unplugged one cord, a different one, out of each, every four or five computers, and they [the students] came in and something wouldn't work and they had to figure out what was wrong... I just kind of stood back and watched. I wouldn't let them tear anything up, but I made them think through, "What do I do?"

Abby, with her access to an iPad said that she believed one of the best ways to use the portable piece of equipment was to be able to access Internet resources on the spot during times she was having circle discussions in her classroom.

Teachers also provided specific instruction based on their students' zone of proximal development. The scaffolding that was seen included,

Abby: She gave different groups different reminders based on their readiness for certain steps in creating the robots. Some of the students had more experience with creating robots than others because of involvement the previous year or not. To some students, she reminded them that they needed to drag and drop icons to set the program. To other students, she reminded them that the movement of the robot was based off of minutes traveled in a certain direction and not off of the distance. To some students, she encouraged them to separate their programming into the movement of the robot and the function of the light sensor; rather than having one program that tried to accomplish both tasks.

Bati: In working with her group of third graders she activated their prior knowledge and walked them through a discussion of expected behavior on the computer. This included a discussion of what steps the students should do to trouble-shoot problems before running to the teacher.

Emilia: To aid in the students' understandings of what to do, she had them critique examples of the wrong way to do the skill.

Kayla: In helping the students learn how to use the Publisher software, she had them talk about how they worked similar functions in other software such as Microsoft Word or PowerPoint.

Whitney: There was a worksheet to help guide the students through the learning activity.

All of the teachers used scaffolding the students' knowledge of what to do by reminding them either of previous times they had used the same technology or similar technology. All of the participants used some step-by-step modeling at some point during their lessons.

Content of Teaching with Technology

The content of the technology lessons in the research included planning for the sequence of instructional activities, choosing of topics that were integrated with the technology, providing a level of complexity, and including critical thinking. These four factors shaped the technology lessons.

The participants' observed lessons seemed to follow two basic sequence patterns. Pattern one was that the teacher modeled what to do, and then the students repeated it on their own computer. In some cases, the teacher would model it to the whole group and then the students would disperse to their own computers. This was frequently done at the beginning of the lesson.

Bati: Students sat at her grouped tables while she showed them on the projector and walked them through a printed off copy of the fake Facebook page. Then students moved to their own computers.

Abby: Students sat at her circle tables and watched the projector as she manipulated the computer to show how to log into the *Stock Market Game* website and how to research stocks for purchasing. Students had computers in front of them, but did not start working until Abby finished modeling.

Kayla: Students watched from the circle tables while she demonstrated what to do in Publisher.

Then, the students moved to the computers to create their own badges.

Emilia: As she explained the different learning centers, she physically modeled for the students what to do at the SMART Board for the “Where is the World North America” lesson, and how to reset the program for the next group of students.

Whitney: Students sat at their grouped desks with laptops open and ready in front of them; however, they did not begin their PowerPoint slides on the laptops until she had modeled what to do using her laptop and the projector.

The second pattern that emerged from lessons was for students to imitate the teacher. As the teacher showed what to do, the students did the same steps at the same time. This pattern of instruction tended to occur in the middle of the lesson, and particularly if the teacher was addressing problems the students were encountering. If several students hit snags, Whitney used the projector to demonstrate what to do next so that they could follow along on their own computer. After a student asked a question to which it was beneficial for all students to know the answer, Abby used her projector to show where to click to find specific information about the companies during their *Stock Market Game* research.

Not all of the room set-ups were conducive to copycat instruction. Kayla’s room had computers in two different, connected rooms. For students who were in the main room where the projector was, she would use her laptop and projector to walk them through problems. When the children working in the storage room encountered problems, she would talk them through it on their computer, point using her finger, or take their computer mouse in her hand to show what to do. In Bati’s classroom, she would either verbally walk them through problems or she might

have the students look over her shoulder while she did it on the computer at her desk, and then they would return to their own computers.

There were two approaches teachers had to developing the content and the use of technology in the lessons. In the first approach, the content was delivered first and then the technology use occurred. Lettie disclosed, “To kind of start my groups to see where my kids were, I had, didn’t even think about the technology at first. I had to learn who knows what.” Examples of this method included Bati having her students research their animals at home and then bring the information to school. She explained, “It’s that little bit of content and then let me try it.” Another example of content first is when Whitney had her students use a variety of resources to research their specific breed of horse for the class book about horses. The research happened prior to each student making their page for the book using the PowerPoint program. Whitney explained, “I just linked them into the wiki and then the first week, instead of working on the project to begin with, I wanted the kids to review these sites, I wanted them to be familiar with them.”

The second approach to dispensing content and using technology was to deliver them simultaneously. As Lettie explained, “I kind of, kind of merge it all together.” Abby mentioned during her observation, that she had tried teaching about investing and then letting the students do the *Stock Market Game*, but she said, “The students do better when they just do it.” Specific topics or domains or skills were taught and the technology was integrated with the learning of content related to the topic.

A large variety of topics were contexts for technology use. All of the participants believed that technology was most effectively taught when it was integrated with other topics. Some of the integration within the data collected was within broad domains. Emilia used

technology in relation to vocabulary building and in geography. Bati used technology to both research and create products within the domain of science, and specifically biology. She said,

Yeah, and there's no reason, you know, to not be able to incorporate the two. Like I said there's so many science things that I want to do. Pushing myself to come up with a plan of how I can show the kids how to use technology and science together.

Lettie used technology to support discussion within the context of a literature study of a novel about the Titanic, and she planned to integrate a geometry unit using graphing calculators and information about the Titanic. At the beginning of the school year, she used it to both assess the students in writing and to expose them to other cultures by "...learning about different parts of the world from the Internet rather than a textbook." Kayla used technology to create products related to environmental issues, and to create journalism products such as newspapers and yearbooks. She said that,

They have to get it out there, get the pictures, they have to get the information about, you know, the club that, let's say it's the beta club, they have about the beta club, have something written up about it, they have to have the members, you know, so there's a lot of little steps within just one page. And then they create that page using the knowledge they know about that program.

Kayla's journalism projects incorporated technology in several ways. She had students using digital cameras, students using recorders for interviews, and students using the computer to write and assemble the products. She said that "It gives it a chance for them to be creative."

Some of the topics integrated with technology were more specific. One of Abby's lessons involved technology in robotics, itself a technology, but she emphasized not only the thinking skills and logic of building the robot, but also the domains where the robot might be used. The

previous year the students created robots that detected fish as part of learning about aqua-science, and during a lesson that was observed the students were building robots that could travel to Cuba and back, and detect underwater caves along the way. The other observed lesson for Abby helped students learn about investing. She shared, “Like, for example, this is going to sound so weird that I was doing this, but we were using mortgage calculators, because I did this whole money unit.” Whitney provided a lesson plan where students learned about the Olympics. One of her observed lessons was a lesson that incorporated both literature and biology. Whitney’s other observed lesson was a science lesson about DNA.

It became apparent from the observations that most of the technology lessons were so complex that they frequently were broken into smaller chunks of learning. Since the teachers had limited time with the students that was further shortened by other nontechnology tasks the teacher planned, the students frequently worked on the lessons over multiple weeks.

The participants tried to incorporate higher order thinking skills into their technology lessons. All of the teachers had some sort of thinking skills display in their room. Kayla mentioned,

...technology, sometimes, it’s so black and white. It’s almost, is it, technology itself for gifted, is that something that, they’re, that’s challenging their, the strategies of thinking and that kind of thing. In a way it is, but in a way it’s very black-and-white. And so I do have a problem with that. Now how we use technology, that’s where you can get into, being able to, you know, be up in analysis and synthesis, like learning.

Emilia explained that her student “Afterwards they have to tell me ‘what’s something that you learned?’, ‘What’s something that, are you using this effectively?’” Bati also asked questions of her students after using technology. She asked them to “Think of new varied,

unusual, other, whatever things you could do with this. How could you use this with your homework? How could this help you at home? How could this help you at school?” She explained that “...[They] usually they’ll come back and teach me something I hadn’t thought of.” Abby finished one of her lessons by having the students write in their design journals, “How they overcame any problems, what worked well and what didn't.”

Sometimes the critical thinking was embedded not in the technology, but in the content of the lesson. Lettie shared this story,

So, for instance, to try that [blogging] last year for the first time, the school has a policy-no gum. Well, the response was, you know, do you think that that should be, or should we change the policy, you know, something to that effect of whether or not they agreed with the policy. And it was interesting to see, when they really started to think about it, and I had given them an article about how much it costs to have gum removed from the floor and the tables in a school. They were able to tell me their opinion, but they were able to synthesize the information they read in the article and really think logically and say, “Well, you know, for most of them, it is expensive to get it off, and people don’t use it responsibly.” So, you know, they’re able to put their answers out there and use that, and be responsible with the technology, in way that they probably wouldn’t have otherwise.

Learning Activities with Technology

The learning activities featured hands-on experiences with technology, practice using technology, and tools to control the pace of the lesson. Most of the teachers expressed some frustration about the lack of equipment for students to frequently be able to have hands-on practice individually. Examples of what the participants said included,

Emilia: I would like to have a couple more computers, so that each one could have and they wouldn't have to double up.

Whitney: ...but it was one school, I had the laptop labs, but no LCD and laptop. And then the other school had the LCD and laptop, but, you know, no laptops. So we're just, it was a difference between hands-on versus...showing the whole class.

Kayla: I would love for all of them to have had a computer in their hand.

In Abby's robotics lessons, the multilayer problem of building a robot, making it move, and making it perform a function allowed for different students to work hands-on completing different parts to create one robot. However, Abby said,

I would probably buy two more robotics kits, because that's one thing that I learned this year, is that I ended up with four robotics classes, and I had four kits. But my classes are too big, so I only had one per class.

Whitney explained why it was important for students to have individual time in hands-on work with technology.

And the taking the turns, you know, having that laptop by yourself too, because that shows you real quick, maybe one week you thought, "Oh, so and so knows what they're doing," and the next week when they're by their self, they're like, this one, and you're like, "Okay, maybe they don't know what they're doing." They're just, you know, sharing with their friend...

The participants used wording in their lesson plans that emphasized that they wanted students to practice using technology. The verbs included phrases like "students will use" and "students will utilize," and all the way up to "students will demonstrate."

Their lesson plans reflected their belief that technology should be in the hands of the students. Examples within the collected lesson plans focused on what the students would be doing. They included phrases such as,

Lettie: Students will be using a SMART board or Interwrite Pad to complete this activity...

Kayla: Students save the pictures on the computer for use at a later date,

Bati: The learner will demonstrate knowledge and skills in the use of computer and other technologies.

Kayla: Students carry on investigating the workings of the camera through shooting several shots. Students continue to take turns until each of the students in the group have taken several pictures.

The participants' belief that students should be allowed time to play with technology influenced this. Bati explained, "I think play is important first. We learn at least how to turn it on or how to work it, the basic, and then let them discover on their own." The online yearbook publishing program Kayla used allowed students to work at home as well as from school. She commented,

Well they can do this, the yearbook, at home. I encourage them to explore but not necessarily save anything. Or if they save something, make sure that they didn't change it from somebody else's work. So they work with, in pairs, or three, in little, small groups, and if someone has already done something and they've already agreed to it then you can't go home and change it. But if it's not agreed to then they can explore.

Teachers controlled the pace of the learning activities. All pushed for students to keep on task due to limited time. In Bati's classroom students were encouraged to approach each other for help before seeking out help from the teacher; however, she still encouraged them to stay on

track with their own work. Kayla verbally encouraged her students to focus on finishing their press passes so that other students would have time on the computer to complete theirs. Whitney monitored the websites the students were visiting. She allowed them to explore if it was something related to what they were working on, but not if the website was unrelated. Some of Emilia small groups working at the SMART Board center practicing identifying states worked faster than others. If she could see that a particular group was struggling to the point where they might not complete the task during their 20 minutes at that center, then she jumped in to place some of the harder to reach states so that each group would finish.

The teachers verbally encouraged the students to keep on task, but most of them also planned pacing tools and strategies into their lessons. Abby included in her lesson plans that “Students decide who will work on building and who will work on programming. They then meet as a group and compare ideas and decide on a design and program for their group, complete a design journal page.” This division of labor helped the students to complete their robots faster. Abby, Bati, Lettie, and Whitney all used a worksheet to guide students. These worksheets were structured in ways that keep the students on track. In some cases, because the teacher required the students to complete the worksheet, it prevented the students from just jumping into the technology portion and wasting time because they did not have enough mastery of the content. In Whitney’s classroom she had to look over what the students had done on their worksheet prior to her giving approval for them to begin on the computer. It helped to guide the students’ organization of the materials prior to beginning with the technology. Emilia, Bati, Lettie, and Abby all had worksheets that helped the students organize their ideas so that they were ready to work efficiently on the computer. Teachers also paced the students by checking for their mastery and quality of work. Whether Kayla was checking to see if the students’ yearbook pages meet

the requirements or if she was doing a spot check to see whether they understood the digital cameras and were ready to be sent out to take pictures, she was the gateway for the students progressing to the next step.

All of the participants prepared the equipment in some way to speed the pace of the lesson. Whitney had her laptops ready and Emilia had her Netbooks on and connected to the Internet so that students would not have to waste time waiting on a computer to connect. All participants mentioned ways that they shared links to the websites where they wanted students to begin working, rather than having to wait for students to find the websites.

Factors concerning the particular students with which the G/T teachers were working also shaped the technology experiences that the participants planned. A discussion about how the students influenced the technology experience is included next.

About the Students

The codes that related to issues about the students fell into three categories. The first included information about the students themselves: background or family life of the students, characteristic behaviors of the students, and the development of authentic learning activities for the students. The second grouping of codes included the goals that teachers had for students: building life-long dispositions, general cognitive dispositions, specific thinking skills, practice with collaboration, development of reflection, and an understanding of the role of the author. The final grouping of codes related to technology use, such as the development of technology-literacy and support for using technology. This section about how student issues shaped educational technology will proceed with examples about student context in relation to technology, then an

explanation of technology goals teachers had for students, and finally, a discussion of students' technology use.

Student Contexts

The students' learning context was shaped by multiple factors. These included their family situation, their behavior characteristics, their levels of engagement, and what constituted authentic learning experiences for them.

The schools at which the data were collected serve a wide variety of students. These students came from families that lived in remote rural locations, families that lived in small towns, or families that lived in suburbs close to a large city. Some students' families had little technology at home beyond a television. Families with computers varied from having anything from a dial-up connection to a high-speed wireless connection. Some students had their own cell phones, iPads, mp3 players, and other portable electronic devices. Parents of these students varied from being permissive to being restrictive of the technology available at home. The different levels of experience with technology influenced how the participants viewed technology. Emilia listed a drawback of technology as being that some children just do not have access.

Lettie in particular had just moved from being at a school where the students were fairly technology savvy to a school where the students were unlikely to have much beyond a television at home. She contrasted the two environments this way,

But having come from a higher income school to now lower income school, I can see it [educational technology] being, the importance of it being, different depending on where you are...Because where I'm at right now, that's so distant [having discussions about the direction of technology development] because they don't even have a computer in the

home. And so for me to just put them with the basic skills of Word, browsing the Internet, you know, determining which information there is useful and not useful, is more important than using the computer to, I don't know [she shrugs her shoulders].

She explained that,

They don't know what those things [game consoles] are. It's really something that is just out of their reach. Because not only is it, you know, low-income, but it's in the country. We're talking deep in the country...It's near a lake so they know a lot about hunting and fishing and, those kind of things.

Lettie's school was working on updating some of their basic computer equipment, and had just started purchasing SMART Boards. She commented that even though her school does not have the "latest and greatest" that,

The interesting thing about it is I really think technology-wise we're probably right where the kids, we're hitting right where, what do they call that zone of development, like with reading or any other thing, because most of the kids who enter kindergarten have never touched a computer.

Whitney's students lived in areas that were not so remote, but she said she had students who told her that they did not have Internet at home or that they had dial-up. Bati's school was in a suburban area near Birmingham. She only knew of a few of her students who did not have access to the Internet at home, but she said those students "...go to the library often enough that they use the library. Or they'll come to school early or stay late. They've accommodated for themselves." Kayla's students were fairly comfortable with technology. They all had it at home. Several students brought their personal iPads on a class fieldtrip, and when she polled her students a "good many" of them already used Facebook in fifth or sixth grade. Abby's school

served students who had access to technology at home. She explained, “I do have kids that have certain restrictions, like there’s a certain time limit, I’m sure the parents have filters and stuff. They all know how to, they teach me how to do stuff.” When Abby gained access to the Macintosh computer in the broadcast room it turned out that most students were able to use it already because many had a Macintosh computer at home. The students at Abby’s school tended to have a lot of technology at home, so she sought out advanced technology, such as the Lego Mindstorm robots.

Some of Lettie’s comments shed light on the role between technology and the students’ backgrounds. She commented,

Where I’m at now [rural, low-SES population], right now my kids couldn’t do that. They could talk, and they could hear it, but they don’t have the technology skills to start dabbling in that [game design, computer programming], whereas at the other school [suburban, middle-SES to high-SES], I think my gifted kids could, but my low kids couldn’t.

However, in Lettie’s school district it was at the high-SES schools that parents held influence over educational technology. She shared this experience,

The school that’s in one of the wealthiest parts of our district is the one where the parents complained about the iPads and said there was not any educational value to it. It was just, basically, for games. And that’s where the whole bandwagon started with, we don’t want those purchased with school funds.

The teachers also touched on how the parents’ level of technology influenced how involved the parents were able to be with the students. Lettie mentioned that her school had a parenting room with access to computers, but that “I don’t think there’s too much emailing going

on either, because they just, they don't have it... The Title I parents just don't have that background." Whereas, Kayla had parents volunteering to come in regularly and help with the yearbook program and the newspaper, and Whitney mentioned,

I've really, I've been surprised. I think that they are going home. I'm constantly telling them about our classroom wiki and I've invited them to be members, and just about every week I have, you know, two or three either parents or kids that have said that they want to be the member, and I, you know, give them permissions.

The behavior characteristics of the students shaped their experience with technology. All of the teachers said that students' knowledge level and ability influenced what they did with technology. Contrasting the difference between ability level of the students and ability related to exposure to technology, Lettie said, "Well, and the low versus high, I can't honestly say that one picks up more than the other...It's about even because they've not been exposed to it. But now what they can do with it, there is a difference." Several participants said that they preferred to work on projects with older students because the older students were more independent in their technology skills. With the exception of Abby, the participants grouped students according to their grade level. Most of the differentiation occurred between what each grade level was doing and not within each grade level. Whitney explained,

I try to differentiate, I try to make it as simple and as easy and as cut-and-dry as possible for my third graders, because really, here in September, they're really still like second graders. And then my fifth graders, most of them have shown me that they use technology at home anyway, and so, you know, they are better with that.

She continued,

I tend to lean more towards technology with my older students because I know they can handle it, you know. Whereas with my younger students, if it's something that they're not familiar with, I realize that it's going to take a good chunk of my time to teach them how to do it before we can actually get to the activity, you know.

Several of the participants had experience in working with students who were not receiving G/T services. Abby commented that the difference between the groups of students was "They [G/T students] weren't scared. They were chomping at the bit to let me let them loose on it. And the other kids needed a lot more direction." She said that when she did projects with the children not in her program, she had to "be a little more prepared and one step ahead" and a little more structured. She remembered,

Well I'm so used to having gifted kids, I realized very quickly how little I knew about it, because these kids didn't know anything about how to use it and they were a little more hesitant to just get on and figure it out like my kids are. And so they were coming to me wanting to know how to do all this stuff.

In addition to ability level, the participants spoke about the importance of student motivation. Emilia explained that differentiation

...just kind of naturally happens, and you know, the planning, like knowing the kids...It all just depends. It depends on the kids. And when they come in and what projects we're working on. Some need more, and some need- can take control of their own learning and are responsible.

Kayla said, "Now you're going to have one or two kids that aren't that motivated to go explore," and Bati shared about a student who did not have technology at home, but uses his time at school wisely to accommodate for what he did not get at home. Emilia complained that students who

were less motivated “They’ll sit there and have been, and they don’t ask. And that just goes, some kids just don’t ask” so that it required her to catch that those students were stuck and needed help.

One benefit of technology was that it opened up a safe avenue for participation for some students. Lettie shared,

I would post one open-ended response thing a week on my blog, and my students could either answer it at home, or at school. They could make time to, you know, use the computer. But they would respond to that open-ended response on the blog, usually one paragraph, and then they had to respond to someone else’s. And, you know, they’d just put their first name on there, and there were kids who would never talk in class who would talk on that thing.

Thus students were engaged at home in addition to school. Several of the participants said that technology engaged students. Examples of what they said included,

Bati: I guess generally, most of the time, maybe, my technology is, I’ll use some form of technology as an excitement, a hook, because you know it usually involves some sort of technology to get excited about whatever we’re going to do. Again, it’s backwards, you know, backup and “Well let’s find out how that happened.”

Lettie: I think that it provides lots of resources for our students, and keeps things interested. It keeps them interested in it.

Whitney: I think it contributes excitement when I tell the kids “Okay, we’re fixing to go get the laptops,” they’re all excited about that... And, I mean, and most of the time I feel like kids prefer the visual and the technology too, just- just me standing up there and lecturing, so I feel like they are paying attention. When you don’t have the computer,

there's more of the tapping pencils or playing with the erasers, or you know you don't have their attention. And, like, if they have the laptop you know you have their attention because they're doing it

Kayla: [Comparing teacher technology in-services to her class time with her students] It's just like when I did that overhead. The ones [students] that were sitting there, they got bored. Because they didn't want to sit there; they wanted to be on it. Once they got on it they were, you know, full speed. But they had to ask a lot of questions because - They'd missed it.

As Kayla's quote indicates technology in and of itself was not always engaging. All of the participants said that students were more engaged when they could put their hands on the technology. During the observations many of the students would slightly lose interest at times when they had to wait for other students to catch up while a teacher was helping the strugglers. Sometimes the interest level was so high that they would forget to monitor minor details. In Kayla's class, a student misspelled her own name on her press pass because she was so involved in creating how her badge would look with Publisher. Additionally, if students were motivated they were more likely to choose to use technology at home related to what they were doing in their G/T classroom. Kayla explained,

Yeah, they do, you know, if we do something here, they'll go home, for instance the geography quizzes, they love to go home and do those. The digital storytelling, they'd come back and bring one on their flash-drive. And say, play this, and I can just hook it up to the overhead and show them. So they enjoy those kinds of things, the ones that enjoy technology and the ones that are motivated.

When given a choice the students picked what was most motivating to them. Abby explained that in her classroom,

I always have some type of warm-up activity when the kids come in. Like, math logic something. We just have a schedule of whose day it is, and when it's your day you get to play a game on the iPad instead of my usual one. But what's funny is that sometimes they'll choose to do an old-fashioned drawing on paper because they just love those.

During debriefing when Bati asked her students to provide one word to describe the lesson that day, the words were a mixture of words relating directly to the technology and words relating to the student's excitement over working on the project.

Some of the ways that participants tried to create engagement was by creating technology lessons and projects that connected to other areas in the students' lives, or projects with authentic uses of technology such as an adult might do. The connections created might be to an area of high interest such as using something similar to Facebook. This was the case both in Bati's project where the students were creating Facebook pages for animals, and in the students' use of Edmodo. In her rubric, Bati instructed the students "Be creative! You may add Flairs, Quizzes, Icons- anything that will enhance your project." Abby had done a unit using technology where the students were learning about finances and using online mortgage calculators.

Authenticity included technology products that were shared beyond the teacher and where the activities students were doing was the same or similar to what an adult might do. Sometimes just the audience of the other students from the class was enough. Bati found that students were very supportive of each other when they were allowed to make comments to each other on the class blog. Both Bati and Kayla had students share their projects for the purpose of other students learning from the student presenting. For Kayla, they shared so that students

demonstrated the range of possible layouts within the computer program. For Bati, the reason for sharing their work was for students to pass on content knowledge.

Examples of authentic technology projects that went beyond the classroom walls included Kayla's newspaper and yearbook projects. She explained, "And then the other thing was when they are creating something, it's exciting to them, they get motivated because they're creating something for their peers to see." Not only were the final products distributed to a wide audience, but Kayla instructed the students to judge the audience and purpose for a picture prior to taking it. Bati's enrichment projects culminated in a community project fair where students displayed their work and explained it to attendees. Abby had the students designing robots that mimicked robots she had found examples of online. In her lesson plans, Abby asked "How do ichthyologists use robotics?" She also had students researching investments like an adult might when determining how to spend their money in the *Stock Market Game*.

Several of the participants had either had students use technology to create projects that were distributed or published in other ways, or had used technology to share students' work. A few teachers had worked with students to create websites in the past. Abby commented,

I really like them to do websites, and you can do it through Google Sites, and that way they feel like this is really something that a true audience is going to see. They're going to take a little more ownership...

Lettie had her students create a project related to their novel study in which they worked collectively to scan their work to make a PowerPoint that would be put on their school TV announcements. Kayla shared student work in slideshow presentations and through flyers they created. A few of the participants had students enter work in contests. The animal Facebook

pages in Bati's classroom were ultimately destined to be part of a contest about animals native to Alabama. Whitney shared,

Oh, we did something with digital photography. We got, we uploaded our pictures and I taught them how to get on the editing, the photo editing sites, and different things and I even had some of those kids print some pictures out and enter them in a school art contest, so that was kind of neat.

Thus the background and behaviors characteristics of the students influenced what teachers chose to do with technology and therefore influenced students' experiences with that technology. Teachers tried to create technology lessons that engaged and motivated students.

Goals for Students

Teachers used technology to aid in the development of student goals. The goals included building life-long dispositions, developing general cognitive behaviors and specific thinking skills, and learning the skill of reflection.

One of the reasons each of the participants actively used technology in their classrooms was that they believed that technology was important to their students' futures. Comments explaining this belief included,

Bati: I would say in, where we, our society, is right now, it's [technology] just as important as reading and math initiatives that we put so much focus on. Because it's only going to get more advanced. It's not going to go away. It's just going to become more advanced, if nothing else. And I think there's probably not enough emphasis in some of the classrooms as it should be.

Emilia: I think it's important. Yeah. That's where the future. If you want our children to be competitive, and to be able to go wherever they want, you've got to have technology. I mean, you, they've got to learn.

Kayla: Absolutely [technology in education is useful]. Because that's our future. I mean, that is our future. They have to know technology....Just, giving them time to be creative, yet use technology, because they're going to have to use it. That's inevitable. So they got to get comfortable on the computers.

Lettie: I don't think they can function in society anymore without knowing, without having a basic working knowledge of it. So I think that it's a priority as much as anything else is... Job skills, I guess, is the biggest thing to me. How they can use it for a job some day.

Bati believed that the students also thought that developing skills with technology was important. She said, "I think if you asked the kids that they would say it's the number one most important thing at school."

Participants were concerned with developing dispositions in students that would serve them over a lifetime. Some of the desired behaviors were broad in scope. Abby wanted her students to "just to keep learning" and "to not be afraid of [technology]." Bati mentioned that some teachers' attitudes towards technology caused the students to be fearful of technology. She explained, "...you have so many teachers that, 'don't touch the computers. Don't break the computers. Don't spill anything on the computers.' And it makes the kids scared of them." Bati and Abby wanted students to be comfortable and respectful of equipment.

Other dispositions were more specific. Within Bati's enrichment projects she stressed that ... kids of all ages, doesn't matter how old you are, you can make a difference. And I use, they're blogging this year, sort of kind of tweaked it and tricked them and would give

them a blog prompt... But with the end, that fun prompt, I actually had the goals of [the enrichment projects]. I wanted to know how they were reaching them. And one of those was just “Can you make a difference in your school? Can you make a difference in your community? Can you make a difference in the world?” And they were at different stages during the project. And by the end, one hundred percent of the kids said “Yes,” they could. To me that’s huge.

The participants mentioned other dispositions as well. Kayla said, “I really think it’s important that these kids learn about routine, and about tedious things, that are not fun that they already know, because in the workforce, lesson plans. We have to do it.” She also believed that it was important to develop creativity. She elaborated,

And in, my philosophy is balance. I truly believe in balance, because you have to give them, I know with gifted students, they feel as though they know this, so why do they have to do it, let’s go on with this. You know, let me have choices, let me decide on my own, let me tell you what we’re doing today. They’ll come in and try to tell me what to do. And sometimes I’ll take their suggestions.

Emilia encouraged the development of understanding other cultures. She said, “...so it’s really, you know, exposing them to other cultures and different things that are going on in the world. Because they all think that there’s Wal-mart around every corner. They don’t know what other, how other people live.” Lettie believed it was important for students to not be too dependent on technology. She explained,

I don’t believe we should deliver instruction totally in technology, because you never know, there may be a point in time where. Well, like the Y2K thing, when they thought everything in the world was going to shut down. What if? What if it does? You need to

know how to do things the old-fashioned way too. So, I think that it can limit us in that way sometimes, because if we focus on it too much then, you know, our kids have lost a whole set of skills that they might need. I mean, for you and I, we didn't go to school with that, but we've learned it as an adult. But imagine. You know, I can see myself functioning just fine without a computer. But I don't know if we teach totally with technology if kids can see that.

Whitney had found a website that allowed students to set goals. She explained, "They [the students] have to go in and give themselves some points, and they earn awards. I have several, even parents, comment that this was great for our house because they were able to... [monitor progress]."

Many of the teachers believed that some of the most important dispositions to develop were research skills, persistence, and communication. Development of research skills was deemed important by many of the participants. Abby explained that "I would say there's drawbacks as far as somewhat of kids learning good research skills, because they start out at age whatever learning how to Google. But that does not mean they know how to research." She further explained that "One thing I really stress is using Virtual Library as a starting point for research instead of Google. And that's a technology thing I do. Teacher research skills." Kayla worked on her students research skills through her project requirements. She said, "They had to use other sources, because that's how, in everyday life now you have to have all different sources." Whitney thought that research was one of the top three skills students should learn with technology. She said they should

...be able to research something and then be able to summarize it and put it in your own words and put it in that project, you know, and not copy, and find age-appropriate web sources, you know, to go to for that type of research.

Persistence was one of the other frequently mentioned dispositions that teachers wanted students to learn. Whitney explained, “But I think it is important to model for the kids, that even not just technology but anything, if it doesn’t work, you know, that doesn’t mean give up, that just means try it a different way.” Abby mentioned one of the characteristics she likes about the robotics units was that it taught persistence. She said, “It never works on the first try, which is something I like about this robotics program. And so sometimes I watch them and I know it’s not going to work and I don’t say anything. Other times, I’m right with them and I don’t know if it’s going to work or not.” Bati had the development of persistence built into her enrichment projects. She shared that for the students,

Yeah. Well they’re [the enrichment projects] not easy. They’re very time consuming, and there’s days that they [the students] may just be in enrichment and all they can do is cry. Because they’re not getting the answers they want. But part of that is learning to find other ways to do it. Because I’m not going to tell you, but I’ll help you. And there are enough resources and ways out there that you can find a different or better way you can do it.

Ability to communicate was another life goal teachers had for students. Comments about developing communication skills included,

Abby: I was going to say how to use technology to communicate effectively, effectively and appropriately. Not just to text, and, but how to appropriately effectively do it.

Bati: Something that I have to intentionally teach my kids, is social, you know, the gifted kids and their social skills. Is they can become so engulfed in the computer and the lack of communication, eye contact, and that type of thing, that is still in one of the first lessons I talk about in enrichment, is that a smile is universal everywhere. And that that's, no matter what, you do have to learn to communicate. That's never going to go away. And that, what you said, I was explaining to the kids, that email is very much left up to interpretation, so we have to be careful too, sometimes it is just appropriate to make a phone call. Or appropriate to, what I teach the kids is, to make a meeting to talk with a teacher. Not an email.

In developing communication skills with the students, the teachers wanted the students to understand to whom and why they were communicating, and then use this knowledge to use the appropriate vocabulary and demeanor in their work. Both Abby and Bati worked with their students when the students were contacting mentors. Abby explained,

What I do, is I, they'll send an email from my school account and they'll say, so I just have to coach them up on what to say. Because they'll start an email, here are my ten questions. Wow, wow, wow. Let's back it up, you know. We'll talk about introducing yourself, and what is your purpose, and how did you find this person, and how can they get back to you. So, there's definitely some education there.

Both teachers worked to develop the students' communication skills for when students were talking to adults. Abby shared, "And we talk about 'you're talking to an adult, you're talking to professionals,' so we're not like, 'Hey, what's up?'" and Bati added, "I tell mine not to use acronyms, OMG or whatever." Part of the reason Bati held a large community fair for students to share their enrichment projects was to facilitate communication skills. Bati explained,

Because, the kids, one of the things they do is like to talk to the professionals, but they also- One of the things that I, you know, I tell the kids is that “You are an expert on this now. But that doesn’t really mean anything unless you share that knowledge with someone else.”

Kayla also stressed to students that they should think about the purpose for their project when they were collecting pictures. Her lesson plan included, “Students are aware that a news article will be added to the picture and to be sure to choose wisely in what they photograph.” The students in her class also worked with the other student or students with whom they were sharing the digital cameras. The students frequently took a picture and then consulted with the other students to determine whether it was a picture worth keeping or if it should be re-taken. Primarily the students consulted within their own small group, but as each small group encountered other groups when they were wondering around the school looking for candid photos, the groups would stop and consult with each other and share photos on the cameras.

Another disposition that the participants tried to develop was students’ skills in group work. Kayla mentioned,

... one thing I was thinking about is it teaches them how to work, team-work, which is very important, and in technology a lot of times you are by yourself, because you’ve got one computer, but when you only have a handful of computers you have to team up.

Lesson plans demonstrated how teachers approached student collaboration. Examples of phrases found in the lesson plans where teachers were building students’ skills in collaboration included,

Abby: Students decide who will work on building and who will work on programming.

Abby: They then meet as a group and compare ideas and decide on a design and program for their group.

Whitney: I want you to work with a partner and use the Internet to learn interesting facts about the Olympics.

During both observations, Abby's students engaged in group work. Due to a limited number of robotic kits, the students had to work in groups, and she gave them the option of whether to work independently or as a group in the *Stock Market Game*. Abby encouraged all students to participate, and the groups did not appear to have a specific leader and she did not appoint one. The students in Abby's classroom tended to consult with other students both within their own group and across the groups.

Most frequently the group work in Abby's classroom functioned as a way for students to divide work to accomplish a larger task faster. In the *Stock Market Game*, students working in groups were encouraged to work independently to research more companies. During center time in Emilia's classroom, the groups that worked more collaboratively were more likely to complete the activity at the SMART Board with placing the states on the map of the United States. In Lettie's teaching situation, her whole class was small enough that they made one group. She also had them work together to divide up the labor for completing their learning task and then use the tablet to add in their work for the whole group to access.

Collaboration was done to encourage some students to explore. Kayla said, "Now you're going to have one or two kids that aren't that motivated to go explore. But when you work in pairs, you tend to find things." In some groups students with stronger technology skills and possibly higher levels of motivation tended to dominate the group. In Whitney's class it was observed that for the students working in pairs to learn the material about DNA, while both students each had times their hands were on the computer, there was usually one student who directed the pacing of the activity and who dominated time working with the computer. Whitney

also had to be sure to test the students independently even if they had been working with a partner. She wanted to be certain both students in the partnership had learned the content.

Students sometimes worked together to solve computer problems. Kayla's students working with the digital cameras would work together to figure out how to use the cameras when they encountered problems. This was particularly helpful if they were in another part of the school away from Kayla. In Bati's classroom, the students enjoyed sharing their work with each other as they added to their animal Facebook pages. If a student had a technology problem, then the classroom protocol was to consult another student prior to approaching the teacher.

In Bati's classroom she had students post something they had learned about their animal on their Edmodo account. Each student's post was then displayed on the page for the class. This collection of students' ideas not only allowed each student in the class the opportunity to see what his or her classmates were doing, it allowed Bati to monitor the students' work. The Edmodo accounts were fairly new when the first observation was completed, so Bati not only monitored the quality of the students' posts but also whether they were able to independently log into their account. Bati's lesson plan had the objective that "The learner will demonstrate knowledge and skills in the use of computer and other technologies."

The teachers expected a certain level of ability and performance out of their students. In Bati's classroom her constant mantras to the students were that they were to go "above and beyond" and to "show me what you know in a creative way." Abby explained her philosophy with this example,

But then that's one way to differentiate when they come to me, is that you have things other than a PowerPoint for your final product. I mean, if you're making PowerPoints in a regular classroom then we got to bump it up here.

Kayla, Whitney, and Bati consistently reminded their students that they were not only to be producing work but work that included creativity. All of the teachers monitored the students' work for basic skills such as grammar and spelling. Sometimes technology features, such as programs that underline misspelled words aided the teachers in monitoring students' work. During their observations, both Whitney and Bati encouraged students to use spell check in the programs they were using. Whitney explained,

Yeah, we type. We've done research papers before, and taught them how to type, and that's a... They want to hit the space bar too many times between words, you know, when they're typing and we had to go back and do that, or, just the simple, you know, underlining, if it's underlined in red it's spelled wrong. If it's underlined in green it's grammar, and, you know, doing the other mouse click, fixing it, that kind of thing.

Additionally, Bati, Abby and Whitney modeled and encouraged students to use correct technology terms when referring to something they were doing on the computer. Abby and Bati tended to question the students when the students were inexact with their vocabulary, and Whitney both used correct vocabulary in context and purposefully defined some words.

Several of the participants shared with the students the rubric for the project before the students ever touched a computer. Kayla also pulled out examples from prior years of what their products could be. The participants emphasized that being in the enrichment class meant that the students should produce quality work.

The participants also emphasized development of cognition in the students. The teachers encouraged thinking, reflection, and development of thinking skills. While most of the teachers regularly did this through other non-technology activities, such as having a problem of the day or

some other brief journal activity, they also used technology as a tool to help develop these cognitive skills.

In the lesson plans teachers emphasized critical thinking skills such as problem solving skills, Abby wrote, “Test- If it doesn't work, students should problem solve to figure out how to fix it.” Kayla included in her lesson plan, “Some experimenting may be necessary with this step [inserting text boxes].” Other higher order thinking skills were also included,

Abby: Students must first complete a design journal page in which they brainstorm ideas for both building and programming.

Bati: The learner will use a variety of technologies to access, analyze, interpret, synthesize, apply, and communicate information.

Whitney explained that she liked having the students give her input about the quality of the websites included in the lessons. She commented, “They’ve already done a website review. They’ve got five websites on there: some of them were good; some of them weren’t so good. But I wanted them to investigate and see which would be the best one.”

All of the teachers used some type of debriefing at the end of their lessons. The debriefings included activities such as writing in a journal, completing an exit ticket worksheet, class discussion, and verbally giving one word about the lesson. Abby included in her lesson plans, “Students record results in their design journal and reflect on their work- how they overcame any problems, what worked well and what didn't, etc.” The participants asked their students to evaluate and reflect on both their technology experiences and about aspects of the technology.

Technology Experiences

Teachers planned experiences for students with attention to developing technology-literacy, advancing understanding of the purpose of technology, acquiring skill in technology processes, preventing problems, providing support, and developing responsible online behaviors. All of the participants talked about how students' ability with technology grew as the students gained in experience with technology. The Partnership for 21st Century Skills and the International Society for Technology in Education term this development of ability as technology-literacy (Partnership for 21st Century Skills, 2004). Kayla, whose students had access to technology at home, shared about the situation at her school,

We have a few that can get on and they just know it. And I say a few. Let's just take one of my classrooms. It has twelve in it. I would say, you know, you've got your four that know it really, really well. I mean I could, they taught me things about the program. Then you have your middle, you know, big clump of kids that could get on the computer, and they fished around, but they were slow to find things, but they eventually did. Then you've got your one, maybe three, kids out of that group that, I mean, they could get on the computer but they just sat there. So they would rather have somebody else come and do it and they'll watch.

Sometimes the teachers would encounter students who had advanced technology skills compared to their age level peers at the school. Whitney commented, "Now every once in a while I'll have that third grader that knows how to do everything." Emilia explained that at her school they were beginning to set up a program where some of the older students with more advanced technology skills would act to support the teachers. She said,

We used to have kids who did technology and come around, and I mean they would, they actually can set up the printers, and do... We've been talking about some kids that maybe could go in and do, we're just trying to get it rolling.

However, most of the participants believed that technology-literacy was related to exposure and the grade level of the child. Whitney explained,

...when I taught with the first- and second-graders, that it was always such a headache.

Just like I kind of had to make myself do it. Once they got the hang of it they were great.

It really helped me out when they got older in third and fourth.

Exposure to technology was thought to be important to developing skills in it. Emilia commented, "To share with them. Because I'm big on, you've got to show them, whether they use it or not, but you want to show it...Exposure. Good word." Lettie, whose current students had little access to technology at home, said, "They don't know what a mouse is. So we're really having to work on just developing the basic 'this is what you do.' It takes a few years, they say, to get them there." She contrasted her current situation with what she had experienced previously,

I mean, last year with my gifted kids I could see going much further with technology because they had been exposed to it long enough that they knew the ins and outs of it, and they were, you know, dibbling in programming and creating video games and that sort of thing.

Most of the participants identified basic skills that students needed to have. Examples of what they said included,

Abby: I do think that there's a place for, especially younger levels, some technology education.

You know what I mean, like, how to do a Word document, an Excel document, whatever programs you're using.

Emilia: I feel like they need to know how to use the documents. I think that is important, whether it is the Google Docs, because I've just come in, to Microsoft, I think it's very important that they just know how to use the documents.

Whitney: Word processing definitely, and then I guess the typing, you know, I hate to say something like PowerPoint or something because I know that's going to phase out, it's not, I mean it's already, they're so many other things that are similar to that... I really do think somebody should teach them typing. I mean, it's not, I guess it's just so basic, you know, but it's really, you use it for everything. Or maybe you do, I don't know. They all, everybody texts now so they just use their thumbs.

Lettie: ...the Microsoft Words and the PowerPoints and that sort of thing. It's important for me for my students to know how to use those, because that's essentially how you get a job and keep it now... I just don't think we need to get hung-up on advancing them to the latest and the greatest and developing technology over making sure they have the other things down too. I think it has to be balanced between the two.

In Lettie's school district she was part of the technology team and her district had put their technology standards by grade level on their website. She shared,

They have it broken it down by grade level, and what they want them to be able to do.

And by the time they leave Kindergarten they should be able to use a mouse and click.

They should be able to identify a monitor and a CPU... Anybody who does anything

that's using technology, we are looking at the standards for that particular grade level, and making sure that we cover them."

However, if other school districts had technology standards, not all of the teachers were aware of them. Whitney said, "I mean, other curriculum areas we have that, like third grade you should be able to do, and fourth grade, and we don't have that with technology."

The teachers tried to develop students' technology skills by helping them become fluent in the steps and processes and by coaching them to use more advanced features of computer programs. Participants named very specific steps and described specific details they wanted in a project. They listed where to click and what to look at when completing specific tasks using technology, and all modeled what to do on their computer using a projector. In her interview Emilia emphasized the importance of learning basic skills, she said,

They're just, they don't know how to. I don't know if that's just a generation, I could go off on another thing, they want you to do everything for them. But I think there's, you know, there's techniques to learn.

She further explained ways that she might address helping students master the basic skills of technology. Emilia mentioned, "When I went to that 21st Century Classroom, they gave some ideas on, you know, just the keyboarding. Just having them learn the middle row. Get them spelling simple words with it."

Kayla explained that the student needed to be able to work with the various programs they would be using. In her interview Kayla gave an example "I had the overhead going on, and I had our online yearbook's webpage up, and I was going through the program so that they would know how to use it." In one of her lesson plans, Kayla included specific features of the Publisher program that she wanted the students to use. She wrote in the objectives for the lesson that

students would be able to “insert Word Art and a Text Box,” and then in the assessment of the lesson she included that their work “should consist of a border, a text box, and a Word Art block.” In the second lesson plan Kayla submitted, she both demonstrated and checked for student ability in being able to “have a basic Microsoft Word skill of typing, font and font size changing, and other basic skills such as alignment, indenting, etc.” Kayla’s lesson plans also acknowledged that some students may be ready to use more advanced features of certain programs. She included an extension that, “For advance students, they may explore further and add clip art, color changing, and inserting of shapes.”

Technology can be a resource or tool for completing other tasks; however, understanding the functionality and, therefore, possible purposes for technology influenced what is done with the technology. Purpose connects between the high level concept of influence of equipment and the area of the development of technology-literacy that relates to issues about the students. Teachers wanted students to understand the purpose for using particular technology and to be accurate in that understanding.

Teachers not only wanted students to be able to use technology, but to accurately understand the purpose of the technology. Samples of lesson plan sections that addressed the purpose of the technology included,

Bati: Students will explain how to use social media tools in the classroom.

Abby: Discuss how robots are used in aquaculture

Kayla: An extension to this lesson would be to have the students insert their picture into

Microsoft Publisher and write a news article for the school newspaper.

Whitney: Use the Internet resources below to fill out the Alien Questionnaire

Lettie: Students will scan their displays using a scanner

Bati stressed students' accurate understanding of the uses of technology. Samples from her lesson plans addressing the accuracy of students' understanding of technology included,

Bati: Students explain the advantages of selected social media tool

Bati: The learner will demonstrate knowledge and skills in the use of computer and other technologies.

Bati: Recognize and discuss telecommunications terms/concepts (e.g., browser, keyword, URL, hypertext, www).

She also differentiated between technology use at home and technology use at school. During the observation she had students use productive thinking to list ways to responsibly use technology at school.

Emilia emphasized that technology was a

Tool, that they're just learning how to use. Even with the, you know, it's funny when they're typing things they always want to push, click, click, you know, the spacebar.

When it's, you know, they do something that is always, and I'm like, 'You don't have to do it like that.' You know, and it's just little things like that.

Helping student understand the basic steps for navigating use of technology relates to the ways in which teachers provided support to the students when they were either encountering problems or just figuring out how to use technology.

By working on technology projects with students, the participants learned about students' skill levels in multiple areas. Lettie shared an example from her classroom. She said, "I think they want to create a brochure of their day, that kind of thing. So, through the use of that, I have seen where their technology skills are, but where they are in other places too." The teachers provided support according to what the students needed. Emilia explained, "It all depends on the

student, because some know more than others. You know, I've got some that can go in and I don't have to worry. And others you have to sit there and kind of guide." All of the teachers maintained that their smaller class sizes allowed them to provide more individualized support to students. Examples of how the smaller class size benefited the ability of the teachers to provide support included,

Whitney: My teacher to child ratio is pretty low. In most groups you've got three or four that know exactly what to do, so the ones that are struggling, I kind of work with those kids.

Abby: ...if you have a small class, I'm right there with them, if somebody gets messed up I can help them.

Bati: I mean, it's, because I'm right there with them. I'm walking around and doing it.

Sometimes the support was provided through the amount of structure in the lesson.

Whitney reasoned,

...but I find sometimes when you just give the kids free rein either they end up on things that maybe they shouldn't be on, or they get frustrated really easily ... especially my third graders will get frustrated with that so I try to pre-pick out things that I think will be interesting but also meet the purpose for what we're using it for.

However, even smaller class sizes did not guarantee that the teacher could get around helping students as quickly as desired. During the observation in Whitney's class the students could be seen to begin using trial and error when she could not get to them fast enough.

Most of the teachers preferred that the students attempt to fix their own problems before approaching the teacher. In Abby's classroom and Bati's classroom, students were encouraged to consult a friend first. Bati elaborated,

You know, so the first week of school we actually brainstorm and come up with, these are some things we can do first, the next thing we can do is ask a friend, if that still doesn't work then come get me and we'll, you know. But don't bring me a computer if the battery's dead and tell me it doesn't work. But they'll do it anyway.

The G/T teachers encouraged the students to try to trouble-shoot their problems. Bati explained that her students and Abby's students were good at trouble-shooting "...because we both teach them first and sarcasm goes a long way with gifted kids. 'Do not come tell me your computer's broke if it's not plugged in.'" Several of the participants complained that the children had been socialized to be too dependent on the teacher.

Whitney elaborated,

...that's public-school education. I mean, you're taught to raise your hand and ask the teacher and ask the teacher and ask the teacher. And I get that, you know, in other situations, but sometimes with technology, I mean, you've just got to- and I don't want to ... Raise their hands, just constantly, and, you know, you just want to say, just, you know, "get in there and click and try," and they do get to that point, but I just, you know, it's a lot easier—it's always a lot easier—with my fourth- and fifth-graders versus my third-graders

In their lesson plans certain tasks had very specific instructions about the process of what to do. Examples of lesson plan writing that indicated where teachers were trying to prevent potential problems included,

Kayla: Review the power, zoom and wide, flash, review and delete buttons

Whitney: PLEASE BE SURE TO CHECK OUT ALL THE WEBSITES BELOW FOR

ANSWERS!!!! [All capitals were added by the participant, and the text was red.]

Abby: Run program. Teacher should make "fish" swim in front of light sensor to test.

Additionally, participants planned ahead in other ways, such as having extra computers already running in case one computer froze. Whitney regularly set up extra laptops. Kayla mentioned, "I go over there and try to troubleshoot and try to work and if we can't do it it's like go get on this computer." Whitney had a backup plan. She was getting ready to begin a new unit with her third graders. She said,

I've already got several websites that I want them to visit, and I've also checked out several books too. So, I'm planning, if the computer's overwhelming, and they just can't do it then we're going to back up to the books. But I like, technology is usually my first choice, but, I'm open to other stuff too.

Support was provided in many different ways. All participants modeled what to do using a projector, and then would model steps again if needed. The participants explained,

Whitney: Well I like to model it before they do it. I'll model how to do something on the computer with LCD and say "this is the website we're going to. This is what we're going to do." And then I give them the laptops. I usually don't just let them, you know, go at it before I've shown them what we're doing.

Abby: So I knew ... it was going to ask questions they don't know, so, you know, I've got a projector so I can project my screen onto the screen, so we would look at that and we kind of did one together, and "here's the links you need to use," and then letting them do it.

Some of the teachers had access to other adults who could help the students. Bati had her district technology coach who would work directly with students. Kayla had some access to the representative from her online yearbook program. She also commented,

We have lots of parent support. So if I wanted a parent to come in, I would, I have parents that beg, “please let me come in every Tuesday.” ... I had the two this morning that I met with, one’s going to help me with the Publisher for the newspaper, to make sure that the children have entered the whole story on the newspaper.

Some of the participants, in addition to allowing students to seek help from peers, were able to use other students to provide peer support for technology. Whitney explained, “Or, you know, if you’ve got a student that’s tried something before, then I may let them come up and show everybody how to do something. Sometimes they’ll listen to their peers before they’ll listen to me.” She did caution, “Some kids don’t want to help. They’re frustrated that you’re even asking them to help.” Kayla also had used peer support. When she took students to work in the library, Kayla said,

... I wanted two children that were already computer literate to get on there and be able to fill it out and feel comfortable with that, so that when I took them to the library I could get the other kids on it and they could be my helpers.

Whitney also sometimes paired students so that students would “have a partner that kind of knows what to do and one that doesn’t. They can work together and help each other.”

Bati also followed the lead of her technology coach. He provided tutorials to the teachers so she also provided tutorials to her students. She explained that for her tutorials, “I’ll proof them first. I’ll find them...Already existing ones” and she created her own. When she created her own she said,

I usually try to have it written, as well, just for the different learning styles. You can watch it and listen to it or you can have it on a piece, because some kids do have to go

back and go through steps again. And have pictures, type thing, like that. And then a lot of stuff I link to my wiki so you can go back and find them again.

The previous year she also discovered that students liked creating tutorials. She said the benefit of the student created tutorials was that, “The big kids like to make their own for the little kids. And that, it’s always fun to see from their perspective. They put it in kid terms which is always better.”

One of the technology-literacy issues that all of the teachers were concerned with was in teaching students to be responsible with their technology use and in their behaviors on the Internet. Responsible behaviors included not posting personal information online, not plagiarizing by copying and pasting information from online, being respectful and courteous in online communications, and evaluating information found online for veracity.

Bati’s lesson plan included the objective that students should be able to “Recognize, discuss, and model responsible and safe behavior using online resources as a class/group/individual.” All of the participants stressed Internet safety at some point during their interview. Examples of what they said included,

Bati: I would say the number one thing, and I sound like a really old teacher, is safety. Is that there’re still a lot of predators and a lot of people looking for kids to make a mistake so they can find out more about them and who they are. And the whole “Once you put it out there you can’t get it back,” thing. And your whole digital footprint. Safety.

Lettie: Or even like you and I talking. Now I happen to know you before, but for a student to just see someone and start talking. You can’t trust. Just because you can see them doesn’t mean that they don’t have other intentions on the other side that could harm them,

because that just seems to be such a huge thing. But to use it responsibly, and to be a good digital citizen.

Whitney: Honestly, I usually pick it [websites] out for them just because, especially with my fifth graders, it makes me nervous to know they're just online, looking and, you know, in our system we do have something called a Net Nanny. It blocks a lot of things that are inappropriate, but I find sometimes when you just give the kids free rein either they end up on things that maybe they shouldn't be on.

Abby: I'll just open a Word document and put, you know, ten links, and put that on the shared drive and say "Before you set out on Google, I want you to use these ten." And usually they'll just stay on those. But just that's more of a safety thing, because I know that those are [good].

Several of the teachers were concerned about students either intentionally or unintentionally committing plagiarism. In Bati's lesson plans she wrote objectives that included that students would be able to "Recognize that Copyright Laws protect creative work of individuals/groups/companies by citing sources." She also taught the students how to respectfully use the information they found online. Her lesson plan included the objective, "Locate, select, organize, and present content area information from the Internet for a specific purpose, an audience, citing sources." Whitney admitted, "I worry about plagiarism, though, you know, they copy and cut and paste when we are making PowerPoints and things and I'm like, 'No.'"

The participants also wanted the students to be respectful digital citizens. Kayla told her students to be wise about which photographs they choose to put in the yearbook so that they did

not favor their friends over other children. Kayla had recently taken the students on a field trip and she shared this experience,

However, it [technology] does, unfortunately, promote, maybe not promote but can initiate, bullying. I don't like that. I don't like, we were on a field trip and they had their little DS's, and they could write it, you know, right here, and they'd write it to their little friend that's up on the third seat up. You know, so-and-so likes so-and-so. Got upset. Had some problems with that. So I don't like that part of it.

During her observation, Bati held a group discussion reviewing online behaviors and specifically about what appropriate use at school looked like. Bati had students post discussions or blog comments online only after she had first worked with them. She would gradually open up to more public posting for classmates to read. Bati said she generally found that by training the students how to comment first, her students generally were respectful in their online writing. She explained,

But that was one of my favorite things, is seeing how positive they were with each other, and their remarks, and that one maybe frustrated something, and the other one would say to them, "Well I took a little bit of time and I found this out about your project, maybe you could go to this website." And that's huge. For, you know, they wanted to help each other. That part's huge.

Both Bati and Abby believed that it helped the students to develop responsible behaviors when they realized that other people could see their online work. Abby shared,

Like my kids, I really like them to do websites, and you can do it through Google Sites, and that way they feel like this is really something that a true audience is going to see. They're going to take a little more ownership.

The participants also taught students to question and check sources when finding information online. Lettie explained, “But I think the most important thing is for them to be able to recognize and discern that just because you see somebody’s picture on the Internet that there’s somebody [being honest].” Whitney worked with her students to evaluate websites when doing research. She said,

They’ll search something on Google, and they’ll go to that first link that may be something that’s sponsored, and I’m like, ‘No, you can’t go to that one, you have to scroll down and, you know, judge which one would be the best one to go to, you have to go back and try different things.’

Summary

The data collected from the six G/T teachers were found to have 41 code labels that sorted into four themes. The themes included characteristics about the teachers that influenced how they used educational technology, factors about equipment that influenced technology use in the G/T classrooms, pedagogical decisions the G/T teachers made in relation to using technology with students, and issues about the students that influenced how the teachers used educational technology in the classroom. The theme of pedagogy had three subthemes that included characteristics of teaching with technology, content taught with technology, and learning activities that used technology. The theme about how students influenced educational technology had subthemes that included student contexts, goals for students, and technology experiences. The next chapter will include a discussion of the research results and their implications.

CHAPTER 5

DISCUSSION AND IMPLICATIONS

Introduction

This chapter discusses the implications and findings from the research. First, there is a summary of the rationale for the research, why it contributes significantly to the body of literature concerning educational technology and education of G/T students, and a reiteration of the research questions that focused data collection. Next, there is a discussion of the major findings of the research in relation to the research questions, implications for practice, and suggestions for future research. Finally, there is a discussion of the context of the research and a conclusion.

Purpose of the Study

The purpose of this study was to examine how teachers of the gifted and talented (G/T) used technology with students. A phenomenological multi-case study methodology was used to qualitatively examine what was occurring in six G/T classrooms where there was a high level of technology use. The study described what was already present in the classrooms, and did not manipulate or control the technology use by the teachers or the students.

Rationale for the Study

Although teachers use technology for a variety of purposes at school, the focus of this study was how teachers think about learning activities in which students actively use technology (Bebell, Russell, & O'Dwyer, 2004). The study's findings support previous research: how the teachers use the technology depends on the content they are teaching, the pedagogical decisions they make, and the technology being used (Koehler & Mishra, 2005). Teacher decision making influenced the students' experience with the technology (Couse & Chen, 2010).

The Partnership for 21st Century Skills (P21) developed the Framework for 21st Century Learning, a set of skills that the members of the P21 organization believe will be important for students to develop to be successful in the careers that will emerge in the future (Partnership for 21st Century Skills, 2004). The International Society for Technology in Education (ISTE) has also developed standards for students so that they are fluent with technology (International Society for Technology in Education, 2010). The ISTE standards are completely contained within the P21 Framework. The National Association for Gifted Children (NAGC) has its own Programming Standards that overlap with the ISTE standards and are also completely contained within the P21 Framework (International Society for Technology in Education, 2010; National Association for Gifted Children, 2008; Partnership for 21st Century Skills, 2004). The overlap in standards implied that G/T teachers might use educational technology with students in distinctive ways that contributed to the students developing 21st century skills.

Significance of the Study

With the publication of standards to guide teacher decision-making about technology use by students, it was important to discover what G/T teachers were doing with students when their

classes were using educational technology so that educators and administrators have knowledge of the technology needs in G/T classrooms. This information then informs school and district level decision making about technology purchasing, as well as how to provide in-service training to meet the specific needs found in G/T classrooms. Furthermore, since technology can be used to differentiate student instruction (Harrison, 2004), it was important to identify ways in which such differentiation was affecting student experience with technology. Information about the extent and kinds of differentiation can further inform decisions about in-service training.

Additionally, the fast pace development of technology and educational applications potentially create similar development of pedagogy. Surveys and questionnaires are insufficient to provide information about these phenomena. Qualitative research methods were used to give as complete a picture of the teachers' use of educational technology as possible.

Research Questions

Two research questions focused the data collection and analysis for this study.

1. In what ways did teachers' use of technology with gifted and talented (G/T) students shape the students' technology experiences?
2. In what ways did teachers differentiate technology lessons with respect to autonomy, complexity, instruction in technology, and ability level?

Discussion of Findings

Chapter four contains a comprehensive report of both the coding and theme frequencies, as well as a thorough discussion of the four themes and the data. This section addresses how the findings answer each of the research questions and articulate with previous research.

Research Question 1

1. In what ways did teachers' use of technology with gifted and talented (G/T) students shape the students' technology experiences?

Beginning with themes and factors where the teachers had little control, such as what equipment is available in their classrooms, and moving towards conditions over which the teacher had greater control, such as pedagogical decisions, this discussion will address what shaped use of educational technology in the participants' classrooms. Some factors that influenced educational technology use were not due to conscious decisions made by the teachers, but rather from the conditions of their particular teaching circumstances. The most frequently occurring codes across the entire data set were about assets and supports. These are two areas where teachers typically have little control, as assets and expert support are primarily determined by decisions made at either the school administration level or at the school district level. Thus, as found in other studies, decisions made by the school district and by school administration influenced what the teachers in this study did with students (Clausen, 2007; Donovan et al., 2007).

Teachers did not always have access to the most recent and fastest equipment and there were often equipment and features that the teacher would have liked to use but did not have. The distribution of equipment at each school impacted how much individual hands-on experience and practice the teachers could plan with their students. Some of the policies and practices of the schools and school districts, such as what websites were blocked and whether the teacher had any access to a computer lab, narrowed what the teachers were able to do. Sometimes the available equipment dictated how students were able to accomplish tasks. However, the teachers

worked as much as they could around the limitations and presented technology to the students as an almost limitless tool to be used for learning and creative productivity.

Technology assets included the available equipment, software, and access to technology experts for each teacher. During the interviews, the teachers discussed technology equipment they wished that they had. They reflected on the technology available to them, how they had or had not used it, and how it intersected with equipment they would like to use with students. However, in the classroom, teachers worked within the framework of technology available to them, which determined what they were able to do with students. Thus, data from the lesson plans and observations did not include any codes about desired equipment.

Supports referred to technology support that was supplied both to the teachers or the students. As found in other research, the teachers in this study were more likely to use technology when they were comfortable using it (Fleming et al., 2007; Garcia & Rose, 2007; Shaunessy, 2007; Taylor & Duran, 2006). Thus, the issue of support from technology experts came up throughout the interviews. Students are bound to encounter problems when they are working hands-on with technology. In this research as in other studies, differences in versions of software (Garcia & Rose, 2007), equipment malfunctions (Mohide et al. 2006), and desire to use more advanced features prompted teachers to offer students technical support. The observation data revealed a variety of ways the teachers addressed these difficulties. Sometimes students used trial and error to solve a problem; sometimes they sought help from another student. When the school's technology expert was not readily available, the teacher acted as the technology expert for the students. Other researchers have found that support using educational technology is important for teachers who are technology novices (Clausen, 2007); however, this research suggests that technology support is just as important for teachers experienced in using

technology. The participants may have been experts in using some forms of technology, but as these teachers encountered new equipment, new programs, new uses, or new set-ups they sought out the help of their technology experts.

As other researchers have found, long term exposure to technology, both within the classroom and in their personal lives influenced teachers technology use with their students (Clausen, 2007; Fleming, Motamedi, & May, 2007; Garcia & Rose, 2007; Myles et al., 2007; Shaunessy, 2007; Taylor & Duran, 2006). These teachers actively sought out training to help them plan how to better incorporate technology in their classrooms. Such training has been shown to influence teachers' use of educational technology (Clausen, 2007; Donovan et al., 2007; Fleming, Motamedi, & May, 2007; Garcia & Rose, 2007; Koehler & Mishra, 2005). Just as Garcia and Rose (2007) found that preservice teachers imagined how they would use technology in their classrooms, the participants in this study, when exposed to a new technology, envisioned the ways in which they would incorporate it in their own teaching. Some researchers suggest that teachers need increased time for collaboration with other teachers to work on ways to integrate technology in their classrooms (Clausen, 2007; Donovan et al., 2007). However, this research suggests that at least some teachers are currently using technology such as email or professional social networks to collaborate with other teachers who are interested in building their skills with educational technology. In this way, the teachers were not limited to access to teachers within their school building. They could seek out or acts as mentors, coaches, and cheerleaders in developing teaching with educational technology. If the teachers were trying something new, online they could find other teachers who could give them advice about how to approach the new technology. This advice could either be based on having done it themselves before or, in the case that no one else had tried it, could provide a sounding board to help the

participants anticipate problems or give suggestions for how to approach the new technology in the classroom setting. The other teachers might have students with which the participants' students could collaborate with online, or the distant teacher could provide another audience, such as when Bati had teacher friends who also read her students' blog posts. The professional learning circle for the participants was increased due to the use of technology.

The expertise that the teachers had gained was also due to the frequency with which they taught with technology and consistently put technology into the hands of students. Experience gave the teachers insights into how to plan and sequence lessons that used technology. As Clausen (2007) found, experience helped the teachers in this study blend technology with their teaching rather than making it a separate component. From experience, the participants knew the activities the students needed to do before getting on the computer, such as completing research or organizing their ideas on paper. The teachers understood that their G/T students needed some time to explore the technology and to figure it out on their own before being asked to use it in formal ways for whatever unit on which the class was working. Experience also helped the teachers know when they would have to be specific about steps and processes when doing a task with different pieces of equipment or special programs. Teachers had developed an understanding of when to let the students struggle a little bit and when to provide support so that students did not become frustrated, and they also used their knowledge of when students were likely to encounter problems to plan ahead to prevent the problems.

The results of this research speak as much to the characteristics of G/T teachers as they do to how technology is used in the G/T classroom. The teachers' own attitudes towards technology and their general teaching philosophy influenced how they introduced the students to technology. All of the participants encouraged students to play with new technologies through

experimentation with functions and features. As was found in other research, these G/T teachers emphasized creativity, curiosity (Colangelo & Davis, 2003) and motivation (Gottfried, Gottfried, Cook, & Morris, 2004) in the lessons they planned. However, in contrast to previous research when given the choice to explore a new technology versus spending time on a more traditional learning activity (Neuman & Celano, 2006), the students did not always choose the new technology. If the traditional activity was something the students enjoyed, then the new technology was not novel enough to entice the students to explore it.

The code most frequent in the lesson plans was hands-on experience or practice with the students using technology. The lesson plans focused on the students and what they would do in each lesson. During the interviews all of the participants emphasized that putting technology in students' hands was essential for students to gain technology-literacy. All of the participants encouraged the students to draw on knowledge of how to use other technologies when learning about a new technology. In these classrooms, technology was approached with a sense of curiosity. The attitudes and approaches to technology with which the teacher planned student experiences were reflections of how each teacher approached technology herself.

Similar to findings in the literature, data from this study supported the finding that teachers' use of technology directed not only the students during school technology use, but also influenced what they did outside of school, such as when students choose to do independent projects inspired by what they had learned in school (Couse & Chen, 2010; Dove & Zitkovich, 2003). However, the teachers in this research emphasized that students' technology use outside of school depended not just on access to technology, but also on the motivation and interest level of the students. Because the participants gave the students technology experiences with a specific context in mind the teachers always framed technology in terms of being a tool with a purpose.

This approach supports what other researchers have found: educational technology is used with a purpose in mind and not just for the sake of using technology (Baule, 2007; Couse & Chen, 2010; Johnsen et al., 2006; Savannah R-III School District, 2001; Wighting, 2006). The participants in this study, similar to those in previous research, struck a balance between use of technology and more traditional methods of exploring content knowledge (Olszewski-Kubilius & Lee, 2004).

Particularly when the teachers taught a lesson directly about how to use a piece of technology, it was done as part of a sequence of lessons in which technology was going to be used. Similar to previous research findings, participants in this research used technology to present topics and projects characterized by high levels of complexity (Angeli & Valanides, 2009). In line with the literature, these teachers guided the students to use technology to explore topics of interest (Harrison, 2004). However, the time allowed for exploration during school hours was typically limited, and not all students had technology at home that could be used for exploration during leisure time. Additionally, some students were less motivated to extend their learning at home in relation to what was being taught at school. Other researchers have noted that technology extends student learning outside of school hours (McNulty, 2002; Pachler & Daly, 2009). However, this research indicates that access and motivation also have a role in whether learning at home is an extension of the school day. Students who both had the inclination and the equipment to explore academic topics at home were able to achieve greater depth and complexity in their related school projects than students who did not work at home.

The teachers promoted independence with the technology. For the most part, they wanted the students to work and have opportunities to work by themselves. Independence with technology is not a concept or skill that has been explored in previous studies. This attitude is in

contrast to the P21 Framework (2004), which promotes development of collaboration skills in students. The data contained some examples of collaboration by students and students had some online access to either experts or other students with similar interests, but it was clear that independent technology use was the teachers' goal. Students worked in pairs or small groups on occasion, but partnerships were just as likely to be due to having limited equipment as they were for the teacher to have purposefully partnered students. When the teacher did partner students, it was for one student to aid the other either in using the technology or in being a role model in exploring the technology. While teacher support was provided when necessary, students were encouraged to trouble-shoot and figure out technology's functions and features on their own. Thus the data showed that teachers placed more emphasis on independent work than on building skills in collaboration.

Some of the factors influencing how teachers shaped students' experiences came from the students themselves. As found in previous research, differences in access to technology in students' home life influenced what teachers planned and were able to do with the students during school time (Siegle, 2004b). The theme of student factors was the most frequent in the data set, and the ways that teachers talked about technology in relation to students and vice versa emphasize that student characteristics are the biggest determinant in shaping student experiences with educational technology. The teachers selected technology appropriate to the background experiences of the students. As found in other research access to technology outside of school shaped the level and complexity of what students were able to do in school (Ba, Tally, Tsikalas, 2002). The teachers gradually built up students' technology-literacy; often over the several years of contact between the G/T teachers and their students. Students were exposed to higher level functions of technology as the teachers shared with students about the great variety and ever

changing advanced functions and features of technology. The teachers modeled, discussed and demonstrated what students could achieve with technology if the students continually explored and mastered technology skills. Technology was presented as a tool with which a person could do as little or as much with as he or she was motivated to do.

Primarily, the teachers modeled and planned experiences with technology that promoted technology as a tool and a resource. Teachers scheduled times for sharing student work through technology. Technology was integrated, sometimes in complex ways, with a variety of subjects so that students were frequently simultaneously learning content and how to use technology. The teachers used technology themselves in ways that promoted technology not as something extra, but as equipment with a purpose to be used in multiple ways in all domains. Furthermore, technology was promoted as a tool that required responsible use.

Classroom experiences with technology developed the skills listed in the P21 Framework (2004). The P21 Framework includes life and career skills, as well as information, media, and technology skills. The teachers, taking a long-term view, insisted that the students have enough hands-on experiences with technology that they develop skills for future careers. The students' technology literacy skills and the development of life and career skills benefited from the level of teacher-student bonding that occurred in the G/T classrooms. Smaller class sizes and inclusion of multiple opportunities for students to directly use a variety of technology helped students develop technology-literacy. Because the G/T teachers worked with students over multiple years, they were able to sequence students' technology experiences so that the students' skills developed to higher levels than if the students had different teachers each year. Constrained by the limited amount of time each teacher saw her students during an individual week, they focused on helping the students learn how to manage goals and pacing towards completing

projects. Technology was promoted as a worthwhile tool, not always easy to use, but one that with persistence as issues were solved could be mastered. Students were encouraged to work independently, and were given some limited opportunities to practice directing their own learning. Teachers asked students to reflect not only about the content they were learning, but also about their use of technology. These learning activities all support the P21 Framework Life and Career Skills outcomes.

Teachers emphasized to the students that work should meet standards of quality and, to borrow Bati's phrase, should "go above and beyond." In particular, the projects planned by the teachers worked to develop students' critical thinking and creativity, and to some degree, communication and collaboration. All four of these skills are components of the P21 (2004) Learning and Innovation Skills outcomes. Additionally, the P21 Framework promotes students mastering more than just traditional school domains. The G/T teachers integrated technology in a variety of areas that went beyond traditional elementary school content areas. Global awareness, financial literacy, and environmental literacy all found a place in the G/T classrooms. Technology was used to either learn about these topics, or to produce a product that showed what the students had learned. It is clear that the G/T teachers who participated in this research were able to promote 21st century skills while incorporating technology in their classrooms. Schools, or even individual teachers, may choose to adopt the P21 Framework as a guideline for planning projects and curriculum in classrooms.

Thus teachers shaped students' technology experiences through the equipment they used and the pedagogical decisions they made, in the context of characteristics of both the students and the teachers. Students experienced technology in ways that taught them that technology was to be explored, used independently, and integrated in all areas of life, even if it required

persistence at times. Teachers highlighted technology's role in careers and the future; that it is a tool, available in a variety of forms that are constantly being updated. The teachers differentiated casual use of technology from more professional uses, by demanding that students produce quality work. The students were introduced to technology's potential use as a tool for creative productivity.

One finding of this research not explored in previous studies was the level of trust and bonding between the G/T teachers and their students and how that relationship impacted the technology experience. Previous research suggests that preservice teachers imagine technology to interfere with the bond between teacher and student (Laffey, 2004; Snider, 2002), but the data collected in the present study show that experienced teachers do not share the belief of those preservice teachers. There was a high level of bonding demonstrated in the flexibility and freedoms that the G/T teachers allowed their students. Administrators who make personnel decisions and set requirements for G/T services within school districts need to keep in mind the role of the relationship between the G/T teacher and G/T students and the development of technology literacy. Attempts by a school district to dictate curriculum can negatively impact the G/T teacher's ability to plan complex projects that use technology. Changes in the number of years G/T students receive services can both undermine the benefit of the G/T teachers' multiyear perspective on nurturing a students' development in technology, and alter the level of trust that develops between the teacher and the students.

Teachers who do not provide G/T services also provide students with technology experiences. Administrators who believe that fluency in technology is important for all students should examine where they can apply the themes found in this data. Providing hands-on training for teachers and requiring them to actively use technology with students will increase their

comfort level with using educational technology. Quality inservice opportunities can influence teachers to try technology in their classrooms, and requiring frequent use of technology with students will help teachers gain expertise in anticipating the needs of students when using technology. Classroom climates that promote a high level of trust between the teacher and the students may encourage teachers to put technology in students' hands more frequently. Additionally, educational models that allow teachers to have the same students for multiple years can increase the continuity in development of technology literacy.

School districts may wish to examine the ways in which they provide technology support, both for teachers and for students. Technology budgets at school districts should include not just money for purchasing new equipment, but also for repair and maintenance of existing equipment. Teachers need not only help in working the equipment, but also with pedagogical issues. They should be developing lessons that provide students with practice using technology in authentic contexts. The teachers plan learning activities within the parameters set by their school system and within their own comfort level for the level of private versus public sharing of work. This leads some teachers to have students mimic what adults might do rather than to have students fully participate. School district technology curriculum personnel may wish to examine the quality of technology lessons so that teachers are using the technology in meaningful ways with students. In many areas Web 2.0 technologies gives students the capability to participate fully as an adult would, rather than in some lesser way. If teachers are to truly incorporate authentic teaching in their classrooms, then students should use technology in the same way that an adult would.

Individual schools must examine equity of time with available equipment. Teachers in specialized areas, such as G/T services, may not have as much access to equipment as do general

education teachers. Many G/T teachers only have their students once a week for a short amount of time. Access to the equipment is needed by G/T teachers multiple times during the week for different classes, and the access needs to be when they have G/T students. Furthermore, the access to equipment by individual teachers differs depending on whether schools primarily have equipment regularly scheduled for class visits or equipment that is available for checkout on an as needed basis. When access to equipment is regularly scheduled, some teachers may not provide meaningful assignments to students, but instead use it in place of worksheets. These teachers might take time with the equipment that is needed by other teachers who use it in more meaningful ways. However, when equipment is primarily managed through checkout procedures, some teachers may never check it out while others may practically keep equipment in their rooms. Schools must find an equitable way to distribute equipment that meets the needs of as many people, teachers and students, as possible.

The teachers' attitudes of curiosity and willingness to learn new equipment and applications of technology clearly made a difference in this study. Computer technology is now available in some form in every school (Institute of Education Sciences, 2010). New teachers coming through preservice teacher programs will primarily have been educated in classrooms that had at least some technology. As Abby stated "I did not really teach before Internet. So I can't really imagine teaching without Internet." Teachers who have had access to educational technology throughout their education will eventually outnumber teachers who first encountered technology after they had already begun teaching. Preservice teacher programs need to demonstrate the meaningful ways that technology can be used in the classroom and provide opportunities for preservice teachers to experience technology both from a student and a teacher perspective. Universities need to help the professors who are teaching preservice education

courses to integrate technology and to plan opportunities for preservice teachers to practice designing and implementing lessons using technology. Demonstrating integration of technology through preservice teacher education is already supported in The National Council for Accreditation of Teacher Education (2012). The dispositions required by accrediting institutions need to include developing teacher attitudes toward life long learning; what a classroom looks like twenty years from now will surely be different than what it currently is.

Many possible research projects follow from this descriptive study. More qualitative phenomenological multi-case studies should be conducted with participant teachers to broaden the demographics of those studied. Studying teachers from other certification programs and teachers who do not use technology as frequently would provide good comparison data. Additionally, G/T certified teachers who are in general education classrooms, who have been trained in the programming standards from the National Association for Gifted Children that overlaps with the P21 framework, would be a good next group to examine for their technology practices, as they have the same training but their curriculum is dictated by state standards.

Secondary education would also be another direction for research. This study was done with elementary school G/T teachers. Secondary schools are likely to have different curriculum and scheduling requirements, as well as differences in access to equipment, since secondary schools tend to be larger than elementary schools. Students in secondary schools have contact with a greater variety of teachers than occurred at the elementary level, and likely will have had greater exposure to technology due to personal technology use than the elementary school student, which would impact the findings.

Technology is rapidly changing. New advances in technology are making technology more portable, combining more different types of equipment into single packages, and allowing

more people to access the Internet. This same study could be repeated five or ten years from now, and it is possible that the low SES students in the G/T classrooms will be coming from homes where more technology than just a television is present.

This descriptive study could also be a first step towards developing some quantitative measures based on the themes that emerged. A questionnaire using the codes categorized into the four themes might help schools examine their educational technology needs and level of implementation of educational technology.

Additionally, the P21 Framework was used to organize and inform this research, but data collection was focused on description in relation to educational technology. Teachers providing G/T services appear to teach in ways that support the development of 21st century skills. More research needs to be done about how to effectively develop these skills in students. It is one thing to claim that students need certain, somewhat abstract skills, and quite another thing to know how to teach or create the skills in the students.

Research Question 2

2. In what ways did teachers differentiate technology lessons with respect to autonomy, complexity, instruction in technology, and ability level?

Teachers in G/T classrooms did provide some differentiation for their students when it came to lessons that involved educational technology, mostly with respect to student autonomy in content, process, product, or environment. Differentiation of complexity and instruction in technology were not formally planned into lessons, but instead were determined by the characteristics of the students. The participants, as found in other studies, gave students flexibility (Baule, 2007; Ke, 2008). The teachers believed that the flexibility in their lessons allowed the students to work at the level of ability and motivation that was appropriate to each

student. Ability levels were differentiated by grade level, but within grade levels differentiation was thought by the teachers to naturally occur. The teachers believed that differences in the students would cause the students to choose to do more or less with each assignment. The teachers believed the quality, level, and depth of each project would be individualized to what each student chose to do according to each student's level of motivation and interest in the project. The parts of research question two will be addressed in the order of differentiation by ability level, differentiation in complexity, differentiation of instruction in technology, and differentiation for student autonomy.

In a few classes in the study, grade levels were mixed. However, in most of the G/T classes the teacher pulled children at the same grade level into a resource enrichment room. The teachers gave the students autonomy in some areas, but contrary to findings in previous research, did not plan differentiation with respect to differences found within classroom groupings of students (Baule, 2007; Ke, 2008). Because teachers taught students for multiple years, they knew what students had or had not done previously. Most of the teachers based their level of instruction according to grade level.

The codes most frequent in the observation data were support, technology-literacy, and pedagogy. Support the students needed related to the development of technology-literacy. Additionally, pedagogical decisions such as how to group students and the sequence of instruction increased or decreased the amount of support required by the students. All of the participants modeled what was to be done before allowing students to begin work. A verbal description was not enough support. The teachers would physically show the students what to do and then provide support as needed. Students with greater technology-literacy required less support than students who were not as fluent. Students who had a higher ability or skill with

technology than their grade level peers were allowed, and even encouraged, to provide peer support for other students. Additionally, students who had higher ability levels were encouraged to move at an accelerated pace when creating products with technology and to explore more advanced functions of the technology. One teacher included in her lesson plan a note about what more advanced students might do with the technology the class was using for the lesson. Other teachers differentiated other parts of the lessons, but not the actual use of technology. For the most part, the teachers appeared to allow students time to explore and work on project independently. In this way it was believed, students naturally differentiated their own lessons themselves according to ability.

Teachers believed that students also differentiated for themselves where complexity was concerned. Teachers said that students completed projects at their own levels. The teachers presented a project that incorporated technology, and after meeting the minimum requirements set by the teacher, the students who were more motivated or more capable, did more with it. This fits with previous findings about the link between motivation and success (Gottfried, Gottfried, Cook, & Morris, 2004).

Instruction in the process of using technology was done whole group for the initial instructions for learning tasks. When multiple students encountered the same problem, small group teaching occurred. Instruction was done one-on-one when individual students encountered problems. Teachers did not appear to preplan differentiated technology instruction when it came to the processes of how to use equipment, but were more reactive in their differentiation. When students needed to know how to do something, either because they were having technology problems completing the learning activity or they were motivated to try something above and

beyond what the rest of the class was doing; they sought the teachers' help, and the support and instruction was given.

Teachers were more likely to plan technology instruction that allowed for differentiation when it came to actual technology use. Teachers provided individual scaffolding for students when they were learning tasks that involved technology, such as what to post in blog comments. In contexts like blogging, the teachers required individual correspondence with the teacher or another adult to practice appropriate online behavior prior to allowing the students to post openly. Additionally, once the product had met minimum requirements, the students' motivation and interest influenced the end product. That is, the more motivated and interested a student was in the project, the more elaborate, in-depth, or complex the final product became. Student interest was in some cases increased by allowing the students choice in the content of what was being taught.

Student autonomy based on interest was the area where the most differentiation appeared to occur. The teachers would provide the students with choice as to the specific topic within a domain or websites and materials from which to learn content. Most of the teachers wanted students to begin with certain websites, but if there were additional websites students wanted to use, the G/T teachers typically allowed them. As found by other researchers, students were more likely to pay attention to the topics on a website and whether the topics were of interest, then whether the information on the website was higher or lower than the students' academic ability levels (Neuman & Celano, 2006; Olszewski-Kubilius & Lee, 2004). When students were learning a new task or process using technology, the teachers were very specific about the steps to accomplish the task. On the other hand, when students were already fluent in using the technology they were given independence to complete the task in whatever way they chose.

Occasionally, the teachers gave the students choice in what a final product would be, but in most cases the basic form of the final product was decided by the teacher. However, students were given autonomy in the details. The students were allowed to complete the product in creative ways, and they had choice over options such as color, font, and formatting. Students also had some choice in their learning environment. In classrooms that had access to more portable technologies, the students had the option of moving; however, most students stayed where the teacher had originally placed the equipment.

Thus, teachers believed that students naturally differentiated the ability level and complexity of lessons due to motivation, interest, and the students' ability level. Differentiation of instruction in technology, by contrast, was mostly reactive. Teachers provided the support that was needed, as it was needed, in developing students' skills in the processes of technology. When technology instruction was about the ways in which technology could be used, either structures were in place that allowed for individualized scaffolding or there was room in the assignment for students to provide individualized responses in their products. The area where teachers gave the most flexibility to students was in choosing the content, process, product, or learning environment within the framework established by the teacher.

Policy makers, administrators, and other who set educational agendas related to students developing technology literacy, should realize that teachers plan technology use around issues related to the characteristics of the students they serve. Technology literacy standards may need to be based more on students' exposure to technology, both inside and outside of school, than on what students can do in a particular grade. Either students from backgrounds with little experience in technology need to have greater access to it at school, or students with copious exposure to technology outside of school need to have more advanced standards.

Additionally, just as there are programming options available to address high ability students' academic achievement, there should be options available to students who have more advanced technology skills. These students could be given the option to provide support to teachers, as Emilia's school had done in the past, or could be encouraged or required to use technology in more advanced ways. This could be done through times when technology is used as a resource for learning or when technology is used to create a product to demonstrate learning.

One surprising aspect of this study was the findings about differentiation. The fact that purposeful differentiation is not being planned into lessons in regards to ability has many possible causes. It is possible that the educational training of these teachers was not sufficient in regards to developing lessons with differentiation. It is also possible that the teachers did not have sufficient planning time to develop differentiated lessons according to ability levels. It is also possible that the teachers truly felt that the range of self differentiation available to students within their lessons was truly enough to meet their students' needs. This research focused just on technology use, but the degree of differentiation throughout all teaching in G/T classrooms could be the subject of research by itself. More research is needed to determine whether adding differentiation to technology lessons would make a difference for student learning. However, the limited autonomy the teachers did provide to the students as far as appearance or specific topics within learning units appeared to be motivational to students. Allowing choice in appearance and/or topics are ways that can easily be incorporated into other classrooms. If increasing G/T students' choices in their education has a positive influence on their motivation (Kimball, 2001), it is likely that increased autonomy in general education classrooms will increase motivation in all students.

Conclusion

This research is done from a teacher perspective. To gain further information about the phenomena of students' educational technology experiences, research needs to be done that focuses on the perspective of the students. This research would necessarily include participants who are students.

Additionally, this research was conducted in very specific contexts. All of the participants not only worked as teachers in Alabama, but were female. Male teachers may create a different dynamic in their classrooms. Other states may have different models of services, as well as different eligibility requirements for G/T services. These factors influence the generalizability of the themes found in the research. All of the teachers were alumni of the same G/T certification program. While the presence of the National Association for Gifted Children Programming Standards may produce similarities among the programs that train G/T teachers, it is possible that teachers who were certified through different programs would have produced different data with different themes.

Additionally, the participants were chosen specifically because they frequently used technology with their students and the teachers believed that the P21 (2004) skills were important to their students. Inclusion of teachers who less frequently use technology with students or who believe that other skills than those listed in the P21 framework are important likely would change the results. All of the G/T teachers included in the study have a level of freedom in determining their curriculum that many other teachers do not have. This freedom in their classrooms allowed the participating teachers to teach in ways or using topics that might not be available to other teachers, and this, too, influenced the results of the research.

Finally, all of the research was done in elementary schools. Inclusion of teachers of secondary education, even G/T teachers of secondary education, might change the results. Thus, there is limited generalizability in the findings. However, the research was meant to be descriptive and was not necessarily meant for the purpose of making predictions for all G/T teachers and how they use educational technology.

This research shows how G/T teachers shaped students' technology experiences through access to equipment, pedagogical decisions, personal traits and experience, and the influence of characteristics of the students. These four themes interact to influence educational technology use in ways that are both consciously decided by the teacher and through factors over which the teacher has little or no control. Within the boundaries that are set by the school district, the G/T teachers seek to provide complex, interactive experiences with technology that integrate the technology into other topics in authentic ways.

The G/T teachers allowed student some degree of structured autonomy when creating products using technology. They allowed differentiation based on ability, complexity, and technology instruction to naturally occur through the interaction of the student with the planned technology activity.

Though technology is prevalent in culture today, students still need teachers to help them develop a robust understanding of the potential of technology to go beyond the more casual usage developed at home. Teachers providing G/T services, due to their freedom in determining curriculum and their multiyear relationship with students, are in a prime position to develop students' technology literacy. Students need help developing the 21st century skills that will make technology an effective tool rather than just a play toy.

Perhaps the importance of educational technology and its relationship to 21st century skills is best put into perspective by this quote from Anthony Chivetta, a high school student from Missouri. He said,

The need to know the capital of Florida died when my phone learned the answer. Rather, the students of tomorrow need to be able to think creatively: they will need to learn on their own, adapt to new challenges and innovate on-the-fly.

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APPENDIX A

Institutional Review Board

Office for Research
Institutional Review Board for the
Protection of Human Subjects

THE UNIVERSITY OF
ALABAMA
R E S E A R C H

February 18, 2011

Susan Zimlich
Department of SPE/MA
College of Education
Box 870232

Re: IRB#: 10-OR-262 "Classroom Practices Using Technology in Gifted and Talented Education Classrooms: Can Technology Help Differentiation and Learning?"

Dear Ms. Zimlich:

The University of Alabama Institutional Review Board has reviewed the revision to your previously approved expedited protocol. The board has approved the change in your protocol.

Please remember that your approval period expires one year from the date of your original approval, 6/24/2010 not the date of this revision approval.

Should you need to submit any further correspondence regarding this proposal, please include the assigned IRB application number.

Good luck with your research.

Sincerely,

Stuart Usdan, PhD
Chair, Non-Medical Institutional Review Board
The University of Alabama



152 Rose Administration Building
Box 870117
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Email text

Dear UA Alumni,

You have been selected to be a potential participant in the doctoral dissertation research of Susan Zimlich. This research aims to describe technology use with students by teachers who are certified in gifted and talented education. Data will be gathered through a lesson plan, a teacher interview, and two observations.

Participation is voluntary and the decision to participate or not participate will not influence your relationship with UA or your employer. Attached is a full letter explaining the research being conducted and your rights as a participant. You may also contact me, Susan Zimlich, at 256-714-7921 or reply to this email to ask any questions you might have prior to making your decision about whether to participate in this study or not.

Should you decide that you are interested in becoming a participant, please reply to this email and send a phone number at which you would like to be contacted. I will contact you to answer any questions about participation and to arrange a face-to-face time to meet and have you sign the consent form for participation. At that time we will make arrangements for collecting data that are convenient to your schedule.

If you do not wish to participate I thank you for your time. If you will please reply to this email stating that you are not interested, that will help me know that I need to look for another participant.

Thank you so much for your time,

Susan Zimlich

INFORMED CONSENT STATEMENT

Classroom Practices Using Technology in Gifted and Talented Education Classrooms: Can Technology Help Differentiation and Learning?

Dear Potential Participant:

You are invited to participate in a research study conducted by Susan Zimlich, from The University of Alabama, College of Education, department of Special Education and Multiple Abilities. The purpose of the study is to examine how teachers use technology in their classrooms. You were selected as a possible participant in this study because you are a teacher certified in gifted and talented education who was identified as actively using technology with students in your classroom.

If you decide to participate, I will collect from you one sample lesson that incorporates technology use with students. Then I will arrange a mutually agreed upon time to conduct and audio tape an in-depth interview concerning your classroom practices and to ask further questions about the lesson plan. The interview may last anywhere from one to two hours depending on how much information you are willing to share with me. Additionally, during 2011 I will arrange two separate acceptable times in which to observe your classroom. Each observation will last about 45 minutes or however long it takes to complete a hands-on technology lesson so that I may record detailed field notes about how you use technology in your classroom. From this data transcripts and records will be made and coded to create a descriptive picture of technology use in your classroom practices. If you would like to include any work samples, journals or other materials that demonstrate or explain how you use technology in your classroom I would appreciate the information in helping to create a fuller picture of how technology is used in your classroom.

There are no known risks or discomforts associated with your participation in this study beyond the giving of your time and reflection. You will be offered a small computer related accessory as a compensation for your time and participation.

Subject identities will be kept confidential by use of pseudonyms in data, transcripts and all published materials.

Your participation is voluntary. Your decision to participate or not will not affect your relationship with your school, school district, or The University of Alabama. If you decide to participate, you may withdraw your consent and discontinue participation at any time without penalty.

If you have any questions, please feel free to contact Susan Zimlich at 205-333-1614 or slzimlich@crimson.ua.edu. You may also contact my dissertation chair Dr. Madeleine Gregg, fcJ at 205-348-1417 or mgregg@bamaed.ua.edu. If you have any questions about your rights as a research participant you may contact Ms. Tanta Myles, The University of Alabama Research Compliance Officer, at 205-348-5746.

If you choose to participate, please keep this letter for your records.

Thank you,

I am willing to participate in the research study entitled: **Classroom Practices Using Technology in Gifted and Talented Education Classrooms: Can Technology Help Differentiation and Learning?**

Name

Date

Phone Number(s)

Email addresses

APPENDIX B

Program Evaluation Survey

21st Century Skills Survey

In order to help us know a little more about the respondents to this survey, please answer the following items.

Name: _____

When did you finish your Gifted & Talented certification from UA?

Year _____

What are you teaching currently?

GT (please indicate grade levels) _____

Other _____

How frequently do you use technology with your students?

Never Rarely Occasionally Frequently Always

Directions:

- In column one please indicate how important you believe these skills are to your students. Circle a number indicating the level of importance with one being of no importance to four being extremely important.
- In column two please indicate how effective you think you are in teaching these skills. Circle a number one if you feel ineffective in your teaching of the skill to a four being you believe you are highly effective in teaching it.

Learning and Innovation:

	Importance to Your Students	Effectiveness at Teaching
1) Thinking creatively	1 2 3 4	1 2 3 4

2) Working creatively with others	1 2 3 4	1 2 3 4
3) Implementing their innovations	1 2 3 4	1 2 3 4
4) Using types of reasoning (inductive, deductive, etc.)	1 2 3 4	1 2 3 4
5) Analyzing complex systems	1 2 3 4	1 2 3 4
6) Making judgments	1 2 3 4	1 2 3 4
7) Making decisions	1 2 3 4	1 2 3 4
8) Solving problem	1 2 3 4	1 2 3 4
9) Communicating clearly	1 2 3 4	1 2 3 4
10) Collaborating with others	1 2 3 4	1 2 3 4

Information, Media and Technology Skills:

	Importance to Your Students	Effectiveness at Teaching
11) Accessing information	1 2 3 4	1 2 3 4
12) Evaluating information	1 2 3 4	1 2 3 4
13) Analyzing media	1 2 3 4	1 2 3 4
14) Creating media products	1 2 3 4	1 2 3 4
15) Applying technology effectively	1 2 3 4	1 2 3 4

Life and Career Skills

	Importance to Your Students	Effectiveness at Teaching
16) Adapting to change	1 2 3 4	1 2 3 4
17) Being flexible	1 2 3 4	1 2 3 4
18) Managing goals and time	1 2 3 4	1 2 3 4
19) Working independently	1 2 3 4	1 2 3 4
20) Being self-directed learners	1 2 3 4	1 2 3 4
21) Interacting effectively with others	1 2 3 4	1 2 3 4
22) Working effectively with diverse teams	1 2 3 4	1 2 3 4
23) Managing projects	1 2 3 4	1 2 3 4
24) Producing results	1 2 3 4	1 2 3 4
25) Leading others	1 2 3 4	1 2 3 4
26) Being responsible to others	1 2 3 4	1 2 3 4

Thank you for taking the survey!

APPENDIX C

Lesson Plan Checklist

Lesson Plan Checklist

Please develop or share a lesson plan that uses technology with students. It should be one of your best lesson plans that you have done, or plan to do with students.

Please include these elements in your lesson plan:

- Standards
- Objectives
- Materials and Equipment
- Technology resources
- Student Grouping
- Learning Activities
- Assessment
- Extensions/ Modifications

Please also include information about where this particular lesson is in relation to these issues:

All students completing the same tasks.....This lesson is differentiated (How so?)

Student-centeredTeacher-centered

Students have many choices..... Students have few choices

APPENDIX D

Interview Protocol

Possible Introductory questions

- What kinds of technology do you use personally?
 - What causes you to try new technologies in your personal life?
 - Who influences what you try
- What kinds of technology do you use professionally?
 - What kind of training have you received in technology?
 - Is there any link between what you do personally to what you do professionally with technology?
- Please describe the technology you have
 - Directly in your classroom
 - Available in your school
 - How accessible is that technology?
 - How well-maintained is it?
 - How constrained is that use?
- What other types of technology do you wish you had available to you?
 - Why?
 - What do you think would make it useful to you?

Interview Protocol:

- 1) What do you think about the level of technology at your school?
 - a) In your classroom?
 - b) Available to your students outside of school?

- c) What kind of influence does technology contribute to your classroom environment?
- 2) What do you think about technology in education?
- a) Considering all the other things schools are supposed to accomplish with students, how important is technology?
 - b) What kinds of support are important for teachers in learning how to use technology?
 - c) What kinds of support are important for teachers in learning how to teach using technology?
- 3) What are ways for students to use technology?
- a) What are the best ways for students to learn how to use technology?
 - b) What kinds of support are important for students in learning how to teach using technology?
 - c) If you could teach your students only three things about technology, what would you teach them?
- 4) What influences your planning for instruction?
- a) Does this change when you are considering using technology in the lesson?
 - i) In what ways? Or Why not?
 - b) Talk about how you choose whether to use technology or a more traditional approach in a given lesson.
 - c) Where do you start planning a lesson with technology?
 - i) Do you choose a technology and find a lesson to fit it?
 - ii) Do you choose a lesson and find a technology to fit it?
- 5) How do you handle problems with technology?
- a) How do you have students handle problems with technology?

- b) What kinds of support are important for teachers with respect to trouble-shooting technology?
- 6) How do you handle technology literacy with your students?
- a) What is your approach about the attitude towards technology you want your students to have?
 - b) What technology-related objectives do you think are the most important for your students to learn?
- 7) Do you think technology is useful in education?
- a) In what ways?
 - b) What are the drawbacks to using technology in education?
 - c) What do you think influences your use of technology in the classroom?
- 8) Are there types of technology you avoid?
- a) Why do you not use those technologies?
 - b) Do you wish you used or could use them more?
- 9) Please describe how you think teacher technology training should be done.

Teachers will also be asked to do a content analysis their lesson plan. They may be asked to discuss or give further explanation to portions of their lesson and the decision making behind writing the lesson.

APPENDIX E

Observation Field Note Guide

Observation Protocol

21st Century Skills

	Core Subjects		Learning & Innovation			Information, Media, & Technology Skills			Life & Career Skills				
	Subjects (Math, English, Arts, etc.)	Themes (Global awareness, financial literacy, etc.)	Creativity & Innovation	Critical Thinking & Problem Solving	Communication & Collaboration	Information Literacy	Media Literacy	ICT Literacy	Flexibility & Adaptation	Initiative & Self-direction	Social & Cross-Cultural Skills	Productivity & Accountability	Leadership & Responsibility
Standards													
Assessment													
Curriculum & Instruction													
Learning Environment													

Supports