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Differentiation and Technology: A Study of an Elementary School's Use of Technology in Differentiated Lessons

By
Kelly D. Campbell

A Dissertation Submitted to the
Gardner-Webb University School of Education
in Partial Fulfillment of the Requirements
for the Degree of Doctor of Education

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Approval Page

This dissertation was submitted by Kelly D. Campbell under the direction of the persons listed below. It was submitted to the Gardner-Webb University School of Education and approved in partial fulfillment of the requirements for the degree of Doctor of Education at Gardner-Webb University.

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Abstract

Differentiation and Technology: A Study of an Elementary School's Use of Technology in Differentiated Lessons. Campbell, Kelly D., 2017; Dissertation, Gardner-Webb University, Differentiation/Learning Levels/Technology/Differentiation Strategies

The purpose of this study was to examine teacher reports and use of differentiation and to examine the use of technology in differentiated lessons. The researcher posed two questions: (a) What is the association between teacher reports of differentiation use and observed differentiation strategies used; and (b) How are teachers using the differentiation strategies of which they are aware when planning and implementing lessons that involve technology in the areas of content, process, product, and learning environment?

This mixed-method study used three tools for data collection: a questionnaire, structured observation protocol, and a focus group. The questionnaire and observation protocol were previously used and validated by Hobson (2008) and Tomlinson (2000). Interview questions were developed from areas of the questionnaire and the observation form and asked specific questions about technology used for differentiation.

Upon analysis of data, similarities of use of differentiation strategies in two particular areas of differentiation occurred. Technology use for differentiation was also used in these areas. Based on these results, the researcher was able to make recommendations regarding professional development, technology, and suggestions for further research.

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Chapter 1: Introduction

Statement of the Problem

Classrooms have changed only slightly over the past 100 years, in spite of compelling new knowledge about learning how the brain works and what makes effective classroom groupings (Tomlinson, 2014). One thing that has changed drastically over the past 100 years is technology. Technology has rapidly increased in all facets of life and continues to increase at a rate that is overwhelming when trying to keep abreast of the latest technological developments (Smith & Throne, 2007).

Variables that comprise classrooms have been uncontrollable in the past and are presently uncontrollable. Such variables as preferred learning styles, student readiness levels, student interests, and learning profiles are unplanned. Educators can, however, learn to differentiate instruction effectively if those variables are understood. Learning to differentiate instruction effectively allows for the creation of an environment in which all students can succeed and benefit (Tomlinson, 2003). Tomlinson (2003) came to this conclusion after observing a teacher implementing new activities, intensive independent study, and questioning strategies in a heterogeneous classroom with the aim of meeting the needs of all students. The teacher she observed worked hard to come up with ways to grow those who were illiterate and those who were advanced. Some consistent practices Tomlinson (2003) observed during her time with this teacher were implementation of quality curriculum, assignment of tasks that respect the learners, teaching up (providing rigor), using flexible grouping, providing ongoing assessments, and grading in a way that reflects growth. From this study and other studies, Tomlinson (2001) took away the knowledge that students differ in many ways; three of these being learning readiness, interest, and learning profile. In order to maximize the learning potential of each student

in the classroom, these student learning differences must be addressed (Tomlinson, 2001). Even students who struggle have interests, ways that they prefer to learn, and the ability to grow (Lawrence-Brown, 2004). Much research has been done with regard to differentiated instruction and its effects on student achievement. Tomlinson (2000), a widely known proponent of differentiated instruction, discussed the importance of meeting students where they are in education by suggesting that providing differentiation for students will result in higher aspirations and great memories. Tomlinson (2000) said that this is important because teachers can maximize their students' individual potential by attending to student learning differences. Tomlinson (2000) went on to say there is ample evidence that students are more successful in school and feel more satisfied at school if they are taught in ways that accommodate their readiness levels. In addition, Tomlinson (2000) said that another reason for differentiating instruction relates to the professionalism of educators, saying that skilled teachers are attentive to the various needs of students so they may differentiate instruction and, in turn, become more knowledgeable, creative, and professional educators. According to Tomlinson (2000), the most important factor in differentiation that helps students achieve more and feel more engaged in school is being sure that what teachers differentiate is high-quality curriculum and instruction. She went on to say that differentiation has no set recipe. Instead, it is a way of thinking about teaching and learning that takes individuals into consideration and can be translated into classroom practice in various ways (Tomlinson, 2000).

Early work in the field of differentiated instruction by Vygotsky (1978) asserted that in order for students to reach their Zone of Proximal Development (ZPD), they must participate in meaningful learning facilitated by meaningful adult direction. Social

interaction, student and teacher engagement, physical space and arrangement, meaningful instruction, scaffolding, student ability, and relevant content are elements that should be a part of classroom learning (Vygotsky, 1978). Gardner (1983) introduced the theory of multiple intelligences in which he focused on eight intelligences and highlighted the need for instruction that involves problem solving presented in a way that addresses multiple teacher and learning techniques and forms of assessment. Evidence that supports differentiation of instruction continues to be presented to the world of education. An awareness of differing learning styles is an important tool in assisting students with learning development (Strong, Silver, & Perini, 2001). Teachers have been provided models of education based on learning styles which have equipped them with the ability to plan lessons that accommodate students of various learning levels (Strong et al., 2001). One of the questions addressed by this study relates to teacher implementation of differentiated instructional strategies; is there a significant difference between teacher reports of differentiation use and observed differentiation strategies used?

As ideas about differentiating instruction have changed throughout history, so have the tools students use to learn in the classroom. In classrooms across the United States, technology in the classroom is increasing. The Common Core Curriculum, implemented in 2010, requires teachers to use technology when teaching the standards throughout the year (Core Standards, 2015). Furthermore, the Obama administration requested $200 million in the 2016 fiscal year for educational technology state grants meant to help ensure that leaders and teachers have the tools and skills they need to use technology effectively to improve instruction and personalize learning (Office of Educational Technology, 2015). The use of technology and differentiation is important because according to Stanford, Crowe, and Flice (2010), in using technology, teachers

can engage students, vary instructional rates, and vary complexity levels. By engaging students, varying instructional rates, and varying complexity levels, teachers are differentiating for students in the areas of content, process, learning environment, and product and helping them stretch their learning and growing as learners (Tomlinson, 2003). Stanford et al. asserted that technology can help teachers differentiate more efficiently (Stanford et al., 2010). According to the Center for Applied Research and Technology (2015), a research project revealed that technology can help improve student performance in the following significant ways: technology improves student performance when integrated with curriculum content; student performance is enhanced when technology is paired with collaborative learning; technology improves performance when the application adjusts for student ability and prior experience and provides feedback to students and teachers about student performance with said application; technology can extend curriculum content (student-created products, multimedia, video streaming, etc.); and technology improves performance when used in settings where teachers, the school community, and administration support the use of technology (Smith & Throne, 2007).

Purpose Statement

The purpose of this study was to examine the differentiation strategies of which teachers are aware in an elementary setting. This study also aimed to determine the frequency of which differentiation occurs and the frequency of which differentiation occurs when technology is used. Furthermore, the study examined any association between reported differentiation use and actual observed differentiation use, both being important to understanding where teachers are regarding differentiation and how the newly available technological tools are being used by educators. A mixed-methods design was used in this study, which included qualitative and quantitative data and

provided triangulation. Interviews and observations were used in this study to explore differentiation and technology in 12 different classrooms in grades kindergarten through fifth grade. A questionnaire was used to gather data on differentiation from the same participants. The results help to explain the use of differentiated instruction in classrooms with regard to technology and any gaps that may exist between the integration of the two. Results also inspire suggestions for further research on the topic as well as recommendations for improvement in this area. Furthermore, the resulting data prove to be valuable in determining what professional development needs to take place in order to prepare teachers for differentiating instruction in the classroom and to prepare teachers to use technology to differentiate for students. This research is useful to the district in which it takes place as it provides a snapshot of the general use of technology in an elementary school setting and what part technology plays in differentiation. It also provides the district with a snapshot of how teachers are differentiating for students in an elementary setting.

Teachers today are inundated with many tasks to complete. They have the responsibility of improving student achievement, following Common Core standards and local pacing guides, and adhering to high stakes testing and accountability. In addition to these tasks, teachers are charged with meeting the individual needs of the students in their classrooms (McTighe & Brown, 2005). Considering all that teachers are required to do, there is a need for an effective instructional approach to aid teachers in meeting curriculum and testing demands while attending to the various learning needs of all students. Differentiated instruction can accomplish these goals by allowing each student the opportunity to have access to curriculum, tools, resources, and an environment that meet their individual needs (Lawrence-Brown, 2004; Tomlinson, 2000). McTighe and

Brown (2005) recommended that "students participate in an education that addresses rigorous content while honoring different learners' prior knowledge, interests, and preferred learning styles" (p. 236). McTighe and Brown went on to say that all learners should be held to the same rigorous standards. Every student, in fact, should demonstrate longitudinal progress toward genuinely understanding what he or she is learning via six facets of understanding (explanation, application, interpretation, perspective, empathy, and self- knowledge); however, the pathway each student takes toward achieving understanding and related standards mastery must involve a differentiated approach to content, process, and product based on assessment and analysis of every student's readiness levels, learning profiles, and interests (McTighe & Brown, 2005, p. 242). McTighe and Brown concluded that in order to reinforce student understanding of core content, (a) curriculum standards should be unpacked in order to prevent learning and curriculum disintegration; (b) students learn best when they are involved in active, purposeful, and inquiry-based teaching (teaching with questions, problems, and scenarios) and learning activities instead of inactive variations of instruction; (c) assessment should require students to demonstrate their understanding instead of recalling information in a formulated way. This demonstration can include multiple forms such as real-world application, explanations, arguments with supportive evidence, debates, and self-reflection; and (d) instruction that is effective will meet students on their individual readiness level, their interests, and their learning profiles (McTighe & Brown, 2005, p. 236).

The purpose of this mixed-methods study was to explore and describe the use of differentiated instructional strategies in 12 different classrooms and to discover any differences in statistical significance between teacher reports of differentiation use and

observed differentiation strategies. Technology use with differentiation was also examined. This action research involved classrooms ranging in grades from kindergarten to fifth grade in an elementary school setting. According to Butin (2010), in a descriptive dissertation design, "research is characterized by the deliberate and systematic articulation and analysis of issues presently lacking such clarity" (p. 81). Butin went on to say that "Descriptive research is primarily concerned with explaining a phenomenon clearly through the construction of categories and order that can, in turn support later action" (p. 81). This descriptive enquiry allowed the researcher to take a deeper look at teacher perceptions of differentiation and to explain to what extent teachers are utilizing differentiated instruction. It also examined the role technology plays in differentiated instruction. Are teachers using the differentiation strategies of which they are aware when planning and implementing lessons that involve technology? The findings of this study were important because they provided the researcher with information on whether teachers in the researcher's district differentiate for students and, if they are differentiating, how are they doing so? By answering this question, the researcher was provided with a basis for recommendations. The findings also revealed the extent to which technology is used when differentiation occurs. The research revealed teacher use of lessons and activities that address student readiness levels, interests, and learning profiles as McTighe and Brown (2005) discussed and provided the researcher with insight into which areas of differentiation teachers differentiate in most (content, process, learning environment, product). Data for this research are both qualitative and quantitative including a questionnaire, observations, and focused interviews. Questionnaire participants included those who participated in observations and focus interviews.

The culmination of qualitative and quantitative data strengthens the validity of the research findings because both qualitative and quantitative data show similarities (Creswell, 2014). In this case, the data from both quantitative and qualitative data show that teachers consistently differentiate in the areas of content and process, which is where the most technology is used for differentiation as well. The data collected, both qualitative and quantitative, shed light on further research that can be done to improve teacher awareness and capacity for and fidelity of differentiated instructional strategies in the classroom. According to Creswell (2014), triangulation occurs when different data sources are examined and evidence from the sources is used to build a comprehensible explanation for themes.

Research Questions

1. What is the association between teacher reports of differentiation use and observed differentiation strategies used?
2. How are teachers using the differentiation strategies of which they are aware when planning and implementing lessons that involve technology in the areas of content, process, product, and learning environment?

Definition of Terms

In order to understand differentiated instruction in its most basic form, there are several key terms that must be defined. These terms are listed below.

Differentiated instruction. A way of designing and delivering instruction to reach the needs of each student (Weselby, 2014).

Differentiation strategies. Instructional strategies that are used to accomplish the goals of differentiated instruction and to meet the diverse needs of students (Tomlinson, 2000).

Content. The fundamental lesson content that covers the standards of learning set by school districts or state educational standards (Weselby, 2014).

Process. The preferred learning style by which a student learns. Effective differentiation includes providing material for each style: visual, auditory, kinesthetic, and through words (Weselby, 2014).

Product. What the student creates at the end of the lesson, unit, or objective to show mastery of content. This can be in the form of tests, projects, reports, or a variety of other activities (Weselby, 2014).

Learning environment. Consists of circumstances for optimal learning which may include both physical and mental elements (Weselby, 2014).

Learning styles. The learning styles theory "points to individual preferences related to categories, such as environment, emotions, interactions, and physical needs, suggesting that such factors as light, temperature, seating arrangements, demand for concentration, degree of leaner mobility, time of day, and perceptual mode impact learning" (Tomlinson et al., 2003, p. 129).

Constructivism. Commonly known as an approach that says learners construct their own knowledge from understanding their experiences (Doolittle, 2014).

Tiered assignments. Lesson plans that incorporate tiered objectives and thinking techniques as a way to differentiate instruction and guarantee that learners are challenged at levels appropriate with their abilities; while at the same time, they are developing an understanding of the same concepts (Geddes, 2010).

Flexible grouping. Happens when instructional materials are different for differing instructional groups, rather than using the same materials for all groups. Flexible grouping also means that the individual needs of students in small groupings are

met (Tomlinson et al., 2003).

Learning profile. Refers to the ways in which students will process what they need to learn in the best possible way. A student's learning profile is comprised of his/her multiple intelligences, learning styles, and learning environments (Subban, 2006).

Readiness level. Refers to a student's capacity to learn at a given time (Subban, 2006).

ZPD. Refers to Vygotsky's (1978) idea of the level of development attained when learners engage in social behavior. It is distance between a student's actual developmental level and their potential development (Subban, 2006). Teachers can accommodate students by meeting them at their readiness level as they provide them with teaching and learning that is not too easy and not too hard (Tomlinson, 2003).

Multiple intelligences. A theory presented by Gardner (1983) that focuses on eight different intelligences or ways in which students learn. These intelligences include visual-spacial, musical-rhythmic, verbal-linguistic, logical-mathematical, bodily-kinesthetic, interpersonal, intrapersonal, and naturalistic (Gardner, 1983).

Limitations and Delimitations

As with any study of this nature, there are limitations and delimitations. In the case of this study, one limitation was the amount of observation time. Although observations were very informative, they did not allow the researcher to see everything that takes place in the classroom regarding differentiation and technology. When looking at the big picture of the school day, 30 minutes is a short amount of time. It is not likely that all items on the Observation Checklist could be seen in a 30-minute time period. Another limitation to this study was the possibility that the researcher could come in at a time when a routine procedure such as checking homework was occurring. Considering

this, the researcher acknowledged this as a limitation to the study and collected schedules from the teachers to prevent some of these occurrences. There was also a concern that teachers would tweak their teaching if they were aware that the researcher was observing the use of differentiation and technology in the classroom. Since limitations are influences that are outside the researcher's control, there are no specific remedies for these limitations. The researcher, however, created and obtained letters of consent from the teachers that were vague regarding specifics that the researcher would be looking for as observations occurred. The researcher also met with the teachers before conducting observations to ask that teachers not change their teaching during observations and continue with their daily schedules as naturally as possible. Teachers were also informed that all information and observation data collected would be kept confidential and would be completely anonymous. In an effort to reduce the chance that teachers would plan instruction differently on the days they were observed, the teachers were observed at random and unannounced times.

In addition to limitations, this study also had delimitations. Delimitations are choices made by the researcher. In this case, a delimitation of this study was that it only took place at one school. Consequently, the researcher expected that at the end of the study, there would likely be a suggestion that this study be replicated at other schools to see if comparable results could be obtained. In addition, this study was only conducted at the elementary level. This study could be repeated at the middle or high school level to see if related results arose.

Summary

Differentiated instruction aids teachers in strategically planning instruction to meet the diverse needs of students. Although there is a range of literature describing the

use of differentiated instruction, there is a lack of research on how the approach of differentiated instruction is used in classrooms where technology is a big part of instruction. Today's Common Core Curriculum includes a vast amount of technology standards (Core Standards, 2015), thus there is a need for further research concerning differentiation and technology.

Chapter 2 consists of a literature review of works and studies that are important in understanding the history of differentiated instruction as well as the importance of differentiated instructional strategies. By analyzing literature on the topic of differentiation, educators can have a further understanding of how schools can be better prepared for technology integration to coexist with differentiated instruction. Additionally, this study provides information on how to better assist teachers in differentiating in the classroom while using technology to plan professional development opportunities that will impact teaching and learning.

Chapter 2: Literature Review

Introduction and Purpose

As mentioned in Chapter 1, this research aimed to answer the following questions.

1. What is the association between teacher reports of differentiation use and observed differentiation strategies used?
2. How are teachers using the differentiation strategies of which they are aware when planning and implementing lessons that involve technology in the areas of content, process, product, and learning environment?

It is important to answer these questions because learning to differentiate and putting that knowledge into action in the classroom allows for an environment where all students can learn to be creative (Tomlinson, 2003). Student learning readiness, interests, and learning profiles differ; teachers can increase learning potential by addressing these differences (Tomlinson, 2001). By addressing the differences, educators are meeting students where they are and providing them with opportunities to grow (Tomlinson, 2003). Furthermore, when teachers address differences in the classroom, they are asking questions that lead to students meeting their fell potential, such as "what are needs and interests," "what are ways to build motivation that is already there," and "what setting can be created that maximizes learning potential" (Tomlinson, 2003)? It is important to include technology integration into differentiated instruction because technology can improve student learning by supporting curriculum objectives, providing opportunities for collaboration, providing quick feedback on performance, improving performance by being integrated regularly, providing students with opportunities to create projects and extend the curriculum, and providing students with multiple options for taking in knowledge as well as expressing ideas (Smith & Throne, 2010).

This chapter addresses the definition of differentiated instruction by providing key terms and definitions. A history of differentiated instruction is also given, beginning in the 1950s and progressing to more current research. In addition, objectives and principles of differentiated instruction are presented. A theoretical framework is built as well as information on student diversity in relation to differentiated instruction, teacher perception of differentiated instruction, and teacher implementation and utilization of differentiated instruction. A brief summary concludes this chapter and prepares the reader for Chapter 3: Methodology.

Differentiated Instruction Defined

Differentiated instruction, as defined by Tomlinson (2008), involves differentiating instruction to accommodate the diverse ways students learn. It involves common sense and support in the theory and research of education. It is a method of teaching that promotes active planning for student differences in classrooms (Rebora, 2016). Tomlinson (2014) described the hallmarks of differentiated classrooms by saying that teachers in differentiated classrooms must be ready to engage students in instruction through different approaches to teaching and by appealing to a wide range of interests as well as a wide range of learning rates. Tomlinson (2014) went on to say that another hallmark of a differentiated classroom is that teachers make sure students are competing against themselves as they grow and develop instead of competing against one another. Teachers in differentiated classrooms also "provide specific alternatives for individuals to learn as deeply as possible and as quickly as possible, without assuming one student's road map for learning is identical to anyone else's" (Tomlinson, 2014, p. 4). Tomlinson (2014) also said that teachers in differentiated classrooms are flexible regarding time, have a clear understanding of curriculum and instruction, create a nurturing environment,

set clear learning goals, and provide persistent formative assessment.

Furthermore, differentiated instruction has been defined as an individual learning process that recognizes the uniqueness of teachers and students and is shaped by daily classroom trial and error (Hiller, 2011). There are various differentiation strategies that have been provided by Tomlinson (2014). These include stations, agendas, complex instruction, orbital studies, centers, entry points, tiered activities, learning contracts, tri-mind, small group instruction, compacting, choice boards, literature circles, and jigsaws (Tomlinson, 2014). Each of these strategies are defined below.

Stations. "Different spots in the classroom where students work on various tasks simultaneously" (Tomlinson, 2014, p. 103).

Agendas. "A personalized list of tasks that a particular student must complete in a specific time" (Tomlinson, 2014, p. 109).

Complex instruction.

> A strategy that responds to the sorts of academic ranges that frequently exist in classrooms that are academically, culturally, and linguistically heterogeneous. Its goal is to establish equity of learning opportunity for all students in the context of intellectually challenging materials and through the use of small instructional groups. (Tomlinson, 2014, p. 113)

Orbital studies.

> Independent investigations, generally of three to six weeks. They orbit, or revolve, around some facet of the curriculum. Students select their own topics for orbitals, and the work with guidance and coaching from the teacher to develop more expertise both on the topic and on the process of becoming an independent investigator. (Tomlinson, 2014, pp. 116-117)

Centers. "Centers differ from stations in that they are distinct; whereas stations work in concert, centers do not" (Tomlinson, 2014, p. 123).

Entry points. Allowing for differences in learning style preferences when planning and carrying out instruction. Gardner (1991) gave five types of entry points: narrational (giving a story about the concept), logical-quantitative (using numbers or scientific approaches to the topic), foundational (looking at the philosophy and vocabulary that support the topic), aesthetic (focusing on sensory features of the topic), and experiential (using hands-on approaches regarding the topic). Gardner (1991) suggested that students explore a given topic through varied entry points such as these (Tomlinson, 2014).

Tiered activities. Activities that allow a teacher to "ensure that students with different degrees of learning proficiency work with the same essential ideas and use the same key knowledge and skills" (Tomlinson, 2014, p. 133). Tiered activities allow students to focus on essential knowledge at different levels of complexity. The steps for creating tiered activities include (a) selecting an activity; (b) considering student individualities and learning levels; (c) creating an activity that is interesting, is high level, is focused on a key idea, and allows the teacher to teach up; (d) charting the complexity of the activity; (e) providing different versions of the activity at different degrees of difficulty; and (f) matching a version of the task to a student based on their learning profile and task requirements (Tomlinson, 2014).

Learning contracts. "A negotiated agreement between teacher and student that gives students some freedom in acquiring designated knowledge, skills, and understandings that a teacher deems important at a given time" (Tomlinson, 2014, p. 139).

Tri-mind. Based on the work of Sternberg (1997), tri-mind suggests that many people have preference in one or more of these three intelligences: analytical, practical, and creative. Using this idea, teachers develop an activity based on a student's strength in one of these areas (Tomlinson, 2014).

Small group instruction.

> When a teacher's classroom observations and formative assessment indicate that some students are lagging behind in key content proficiency, lack prerequisite content, have misunderstandings about how the content works, or are advanced with essential content, small-group instruction provides a simple and direct way to reteach, review, provide focused and supervised practice clarify misunderstandings, or extend student proficiency. (Tomlinson, 2014, p.147)

Compacting. "Encourages teachers to assess students before beginning a unit of study or development of a skill. Students who do well on the pre-assessment should not have to continue to work on what they already know" (Tomlinson, 2014, p. 148). Teachers can use three-stage compacting to document what students already know, what the preassessment shows they do not know, and a plan for challenging students regarding the topic or skill (Tomlinson, 2014).

Choice boards. Teacher placement of changing assignments in permanent pockets on a choice board. These assignments ask students to make a selection from a particular row on the board. The teacher targets the assignments toward the needs of students (Tomlinson, 2014).

Literature circles. Literature circles were coined by Daniels (2002) and "are a student-centered approach to discussing fiction in which students meet in small groups to talk about what they are reading" (Tomlinson, 2014, p. 148).

Jigsaws. Jigsaws are a three-stage collaborative strategy including a teacher introduction to a topic or idea that jigsaw groups will explore, student group meetings in which students discuss their responsibilities within the group as well as what they have learned, and a sharing phase where students share in a class discussion that solidifies information and ideas (Tomlinson, 2014).

History of Differentiated Instruction

Understanding the history of differentiated instruction begins in the late 1950s as schools began to change. A shift in focus occurred in which schools began to focus more on students preparing, producing, and problem solving instead of the typical teaching strategy of whole classroom instruction (Tomlinson, 2014).

During the 1970s, whole classroom instruction became even less common as grouping students by abilities began to be considered. Constructivism and the exploration of differentiated instruction appeared in the late 1970s and into the 1980s (Tomlinson, 2014). New theories about how students learn were explored and expressed to the world in the 1990s. Theories such as Gardner's (1983) Theory of Multiple Intelligences came on the scene and turned the education world's focus on a more student-centered instruction (Tomlinson, 2014).

Today, best practice with regard to education involves strategies that are student-centered and encompass multiple intelligences as well as learning styles with accountability, collaboration, economies, environments, individuality, and differentiated instruction to accomplish high student achievement (Tomlinson, 2014). Tomlinson (2014) said that several things have changed in the classroom over the past 15 years. These include classrooms have become more diverse, more technology is available for teachers and students, technology regularly opens classrooms to the world and to a realm

of ways to contemplate teaching and learning, educators know more about the science of teaching and learning, national conversations have been focused on what and how to teach children, and more educators are familiar with differentiated instruction (Tomlinson, 2014).

Today's status of technology use in schools has not been determined from a global perspective (Smith & Throne, 2007). Technology Counts is a report that is produced annually by *Education Week*, which surveys states to measure the status of educational technology in Grades K-12 (Smith & Throne, 2007).

Objectives and Principles of Differentiated Instruction

As differentiated instruction became known as an effective way to meet the needs of all learners, the objectives of differentiated instruction became more widely known to educators across the United States (Tomlinson, 2014). Objectives of differentiated instruction include development of student-teacher relationships, consideration of student's individual academic ability, consideration of student interests, consideration of student skills, implementation of appropriate curriculum and problem-solving activities, and an interaction with diverse peers with an ultimate goal of high student achievement (Tomlinson, 2014).

Principles of differentiated instruction include knowing and understanding students, creating a comfortable learning environment for students, providing a proactive curriculum, maintaining high student expectations, varying assessment, and sharing responsibilities (Maddox, 2015)

Theoretical Framework: A Review of Theoretical and Empirical Literature

Theory regarding individualized education for students dates back many years.

Dewey (1997), Maslow (1970), and Rogers (1969) contributed to humanistic theories that relate to differentiated instruction. Throughout Dewey's (1997) writings, an insistence on a moral dimension of life and learning can be found. A belief that moral growth can be achieved through reflection and interaction with others can be found (Bruce, 2008). Dewey (1997) said that

> Society exists through a process of transmission quite as much as biological life. This transmission occurs by means of communication of habits of doing, thinking, and feeling from the older to the younger. Without this communication of ideals, hopes, expectations, standards, opinions, from those members of society who are passing out of the group life to those who are coming into it, social life could not survive. (p. 3)

Furthermore, Dewey's (1997) educational theory expands on the idea that hands-on learning is beneficial to students and that students learn by doing. Dewey (1997) views the learner as needing hands-on experience in order to improve society, which he considers an organic union of individuals (Bruce, 2008). Dewey (1902) said that in the case of child versus curriculum, a child lives in a narrow world of personal experience and contact. They experience what they touch and the world around them. Contrarily, the course of study they are met with in schools presents them with material that is out of their touch and experience. Subjects in schools, according to Dewey (1902), are classified, and facts are removed from their original place and divided into topics and lessons. Dewey (1902) said to "let the child proceed step by step to master each one of these separate parts, and at last he will have covered the entire ground . . . subject-matter furnishes the end, and it determines method" (pp. 7-8).

The idea that students are not commodities produced in factories has led to a more

student-centered school environment. Differentiation proposes a solid framework for the strengths of individualizing education. The theory of differentiated instruction is based mainly on the theory of social constructivism (Vygotsky, 1978) and stresses the active participation of students in the process of learning (Stravoula, Leonidas, & Mary, 2011). Differentiated instruction, although thought of and talked about by others, was first proposed as a teaching practice and termed differentiated instruction by Tomlinson (2000) and is seen as a change in the teaching process by considering the mix of students in a classroom and considering student readiness, interests, and learning styles (Stravoula et al., 2011). Differentiated instruction involves constant reflective practice on the part of the teacher who tweaks teaching and learning that cannot be met by prepared, ready-made lesson plans. Plans for differentiated instruction are tailored to the needs of individual students (Stravoula et al., 2011).

Studies of intelligence of the past point out that intelligence is not a single entity, but it is multifaceted (Tomlinson, 2014). Gardner (1991) said that humans have eight intelligences which include verbal-linguistic, logical-mathematical, visual-spacial, bodily-kinesthetic, musical-rhythmic, interpersonal, intrapersonal, and naturalistic (Tomlinson, 2014). Sternberg (1997) also suggested multiple types of intelligences including analytical, practical, and creative (Tomlinson, 2014). Types and names of intelligences vary. However, according to Tomlinson (2014), research has concluded three important consistencies: (a) we think, learn, and create in various ways; (b) our potential is developed by matching what we are asked to learn with how we apply our abilities to the process of learning; and (c) learners need opportunities to develop and discover their abilities in a range of areas of intelligence (Tomlinson, 2014).

Vygotsky (1978) proposed that teachers should teach within a student's ZPD.

ZPD is essentially the difference between what a student can do without guidance and what they can do with scaffolding and cooperative learning support (Joseph, Thomas, Simonette, & Ramscook, 2013). Studies show that understanding how students prefer to learn may help students receive as well as process information more effectively (Joseph et al., 2013). One way to meet the specific learning needs of students more appropriately and to bridge student learning gaps is to help educators understand how students demonstrate learning levels and how to use ZPD to meet these needs (Least, 2014).

Theory grounded in differentiation of instruction has an impact on educational practices worldwide. Curriculum changes have been witnessed that promote the implementation of differentiation (Stravoula et al., 2011). Research on differentiation theory is mainly grounded on individual theories upon which differentiation theory and practice have been developed. The first research done on differentiation found a growing number of studies and small-scale research that support the improvement of teaching and learning through differentiation (Good & Brophy, 2003; Tomlinson, 2000).

Much research that continues to grow has emerged in recent years regarding the implementation and effectiveness of differentiated instruction. Several of the studies are in reference to specific groups of students such as gifted students or students with disabilities or in reference to teacher perceptions and attitudes about differentiated instruction (Stravoula et al., 2011). A smaller number of studies have been done on the effectiveness of differentiation as a whole (Stravoula et al., 2011); and an even smaller number of studies have been done referencing the use of differentiation when technology is present and readily available in the classroom (Smith & Throne, 2007).

Effective Differentiated Instructional Strategies

Effective differentiation instructional strategies can be used in four areas: content,

process, product, and learning environment (Tomlinson, 2014). Content refers to what students will learn. Differentiation of content can mean a change in the material being taught such as a book report that is required of all students; however, students may choose their own topic to research. Differentiation of process means that activities in which students make sense of key ideas is differentiated in a way that allows students to learn new material in multiple ways. For example, students can use the internet or books or interview a local expert to research a topic. When referring to product in differentiated instruction, product is how students show and extend what they have learned and what they know. By differentiating product, students are allowed opportunities to show their learning in various ways. This could mean that students choose from a formal report, a podcast, an artistic representation, or many other forms of product that would represent their learning (Tomlinson, 2014).

Studies Supporting Differentiated Instruction

Many studies have shown positive outcomes from the use of differentiated instructional strategies. A case study done by Tomlinson (1995) regarding middle school experiences with differentiated instruction showed initial teacher opposition toward modifying instruction to meet individual learner needs. In addition, the study revealed that administrative obstacles included teacher opposition about being asked to implement differentiation strategies by district officials. This opposition impacted the teacher sense of self-efficacy (Tomlinson, 1995). Furthermore, other barriers involved teachers perceiving differentiated instruction as a trend that would pass. There were also teacher concerns about time provided to teachers to prepare for differentiated lessons and unease regarding student assessments and test preparation (Tomlinson, 1995). Observations of teachers who chose to adopt the use of differentiated instructional techniques revealed

that teacher age and experience were not factors defining acceptance of the new paradigm. Teacher attitudes toward change, however, demonstrated a more significant factor. Teachers who embraced change consistently implemented differentiated instructional strategies and showed a greater disposition regarding differentiation (Tomlinson, 1995). Teachers who practiced early triumphs with differentiation were more likely to continue using differentiated instructional strategies (Tomlinson, 1995). Tomlinson (1995) concluded that there was a need to investigate resistance of teachers to new models of teaching. Tomlinson (1995) said that if teachers implement the differentiation model efficiently, there will remain an uneasiness about a loss of classroom control.

Furthermore, a study in the Rockwood School District in Missouri (McAdamis, 2001) reported significant improvement in test scores of low-scoring students after the use of differentiated instruction was implemented. In 1995, talk of more differentiation began when the Rockwood Board of Education adopted a policy saying equality consists of providing for varying levels of individual difference (McAdamis, 2001). Teachers in this study indicated that their students were more motivated and excited about learning. The entire school participated in professional development, mentoring regarding differentiated instruction, and intensive planning to involve differentiated instruction in lessons. Teachers in the district initially demonstrated some resistance to the change. To combat this resistance, peer coaching, action research, study groups, and workshops were offered to the teachers. Their feedback was also continuously collected throughout the process of implementing differentiated instruction (McAdamis, 2001). Eventually, teachers in the district saw the benefits of using differentiated instruction and began to try lessons with differentiation. The study was done over a 5-year period and required

response and input from stakeholders who included principals, teachers, district professional development trainers, and school authorities (McAdamis, 2001). Overall, the study confirmed that the need for a district-wide change was clear; and that over a 5-year period, teachers increased their use of differentiation strategies. According to McAdamis (2001),

> Differentiation has enabled a significant number of Rockwood students to move out of the lowest scoring categories on Missouri standardized tests. Districtwide, the percentage of students scoring in the lowest achievement levels decreased 5% in math, 8% in communication arts, and 7% in science. The state recognized the Rockwood district as one of the top statewide because of the percentage of students scoring "proficient" or "advanced" on the exam, and state officials publicly praised the district's ability. (p. 48)

In addition, McAdamis said that

> The district can also point to improvements among its highest performing students, those who score at or near the 99th percentile on grade-level standardized tests. Success on state assessments is just one measure of differentiation's impact on student learning. Teachers report students are more motivated and enthusiastic when provided with acceleration and differentiation. (p. 48)

Studies Regarding Teacher Use of Differentiation

In another study that examined the differentiation strategies used by middle school teachers in heterogeneously grouped classrooms, Hobson (2008) collected quantitative and qualitative data in the form of questionnaires and classroom observations. In this study, the frequency with which teachers in middle school

classrooms implemented differentiation in their classrooms was analyzed. Contextual and educational factors were also analyzed as well as the frequency of the use of differentiation strategies that meet the needs of diverse learners (Hobson, 2008).

Hobson's (2008) study took place in a middle school in southeastern North Carolina. In this study, teachers were asked questions about how frequently they used differentiation. They were also observed while delivering classroom instruction. Results of the study point out that there are two groups of teachers: teachers who differentiate frequently and teachers who differentiate with little frequency. Study findings indicate that factors such as years of teaching experience and staff development do not have a high impact on the frequency of implementation of differentiation strategies (Hobson, 2008).

A total of 20 teachers participated in the questionnaire, and 13 participated in the classroom observations. The participants varied in terms of the grade level they teach and their subject area. The questionnaire was adapted from Tomlinson's (2000) Teacher/Peer Reflection on Differentiation Instrument. Hobson (2008) had previously used the study in earlier research, and permission from Tomlinson (2000) was granted for both uses. The Differentiation Practices Questionnaire for Regular Classroom Teachers consisted of two sections. The first section contained seven questions related to demographics. Section II consisted of 40 items on the use of differentiated strategies by classroom teachers. The items concerning differentiation strategies were categorized as general differentiation, content differentiation, differentiation relating to the process strategies, the differentiation of student products, and differentiated instructional and management strategies (Hobson, 2008).

The second data collection instrument used in Hobson's (2008) study was the

Observation Checklist of Differentiated Strategies which was used to record data collected from teacher observations. The observation checklist was also developed by Hobson and was also based on Tomlinson's (2000) instrument. Hobson modified the instrument by reviewing the 40 items from the Differentiation Practices Questionnaire given to teachers and selecting 18 of the most easily observed differentiation practices to include on the checklist. Having a limited number of items (differentiation practices) to look for made the observation of data within the 20-minute classroom visit more plausible for Hobson and also allowed the recording of data between observations to be more efficient.

Participants were given 10 days to complete and return the questionnaire. The researcher received 20 completed questionnaires from 42 eligible participants. After consent was received, unannounced observations of 13 classrooms were conducted in order to observe the actual use of differentiated strategies by teachers in the heterogeneously grouped classroom. All grade levels were represented, and all core subjects were observed. Classes were visited at random. The observations were done in a walk-through fashion, and the observer spent approximately 20 minutes in each classroom with several classrooms being visited within a few hours. The teacher participants were informed of the week in which they would be observed but were not told on which day nor during which class the observation would take place. Immediately following each classroom visit, the data were recorded on the Observation Checklist of Differentiated Strategies. Each item on the checklist that was observed was designated with a check. If the strategy was not observed, the item was left unmarked.

Data from the questionnaire Hobson (2008) administered and the classroom

observations were used to answer Hobson's first question, "What differentiation strategies do teachers use to address student characteristics in heterogeneously grouped classrooms at the middle school level?" The Differentiation Practices Questionnaire consisted of 40 items relating to differentiation strategies. Teachers were asked to indicate the frequency in which they used specific differentiation strategies in their classrooms. Eighteen of the items on the questionnaire corresponded to the 18 observable behaviors included on the Observation Checklist. The teacher responses to the 18 items that appear on both of the data collection instruments were selected from the questionnaire and analyzed for frequency.

After collecting the data, Hobson (2008) then analyzed the data and found that the top five most frequently used differentiation instructional strategies as reported by teachers are the same five strategies most frequently observed by the researcher. The nine (top 50%) most frequently used differentiation strategies fall under the differentiation domain of "content" or "process." On the other end of the scale, the three strategies least frequently implemented, as reported by teachers, are also the three least frequently observed by the researcher.

Hobson's (2008) second research question, "What educational or contextual factors influence teachers' use of differentiation strategies in heterogeneously grouped classrooms at the middle school level," was answered with data collected from classroom observations. The differentiation strategies used by each teacher were counted and analyzed to determine the mean. After determining the mean use of differentiation, teachers were divided into two groups: frequent users and infrequent users of differentiation. Teachers whose frequency of use was above the mean were assigned to the frequent users, and those whose frequency of use was below the mean

were designated infrequent users. Using the demographic information collected from the teachers, the researcher created an educational and contextual profile of the two groups. Data showed a mean of 1.5 differentiation strategies used by the infrequent users who made up 66.7% of the sample group. Data also showed a mean of 8.75 differentiation strategies used by the frequent users. These users made up 33.3% of the sample. Last, a correlation was run to see if a relationship exists between the frequency with which teachers use differentiation and the specified educational and contextual characteristics of those same teachers. The results show that the relationships between years of teaching experience and the number of workshops attended were not significantly significate regarding their use of differentiation in the classroom.

Ultimately, Hobson's (2008) data revealed that the majority of teachers report being aware of, and using, differentiation strategies. The data reveal that teachers are twice as likely to differentiate in the domains of content and process (curriculum and instruction) as they are in the areas of learning environment/classroom management and assessments (Hobson, 2008).

Hobson (2008) concluded that the difference found in the use of differentiation strategies implies that there may be vastly diverse types of teaching and learning occurring within the same school building. Hobson stated that

> If you are a seventh grader fortunate enough to be in Ms. Smith's Language Arts class, where curriculum and instruction is differentiated and your personal interests and learning needs are accommodated, you will encounter a completely different learning experience than your friend who is in the Language Arts class three doors down. (p. 39)

Hobson also reported that the study shows that all of the teachers observed and surveyed reported having very little training on the topic of differentiation and recommended more training in the area of differentiation.

Studies Supporting Differentiating Instruction with Technology

According to the Center for Applied Research and Technology (2015), a project of the Sacramento County Office of Education and the International Society for Technology in Education in partnership with Education Support Systems has proven that technology positively impacts student learning when instruction is differentiated using technology (Smith & Throne, 2007). This project revealed six ways in which technology helps improve student performance. First, technology is most effective when it is integrated with curriculum content. Second, studies show that when paired with collaborative learning, technology boosts student performance. Third, when technology application is adjusted for student ability and prior experience as well as provides feedback, technology can improve performance and allow the responsibility of learning to be shared by the teacher and student. Fourth, when technology is integrated into a typical instructional day, student performance is increased. Fifth, opportunities for students to create and implement projects that extend the curriculum are provided more frequently. Last, technology advances student performance when it is used in an environment where teachers, the school community, and the school and district administration support the use of technology (Smith & Throne, 2007).

Technology Counts is a report that is produced yearly by *Education Week* (Rebora, 2016). In this annual report, *Education Week* surveys each state in the U.S. to measure the status of K-12 technology and uses survey data to create individual state technology reports based on various criteria. These criteria are state overview, access to

technology, use of technology, the capacity to use technology, state data systems, and data access/analysis tools. *Education Week* analyzes the data and from each category makes comparisons among the states. A grade is assigned for each category, and each state gets an overall grade (Smith & Throne, 2007).

According to the most recent Technology Counts (2016) survey conducted by the *Education Week* Research Center for this year's edition of Technology Counts, teachers continue to face universal challenges in changing their instruction to include innovative technologies. This survey involved participants from approximately 700 classroom teachers and school-based instructional specialists. These participants represent the views of diverse groups of educators whose schools vary in grade ranges, location, and poverty level (Technology Counts, 2016). The report asserted that the survey results show the complexity of creating meaningful technological change in classrooms throughout America (Technology Counts, 2016). For example, the survey proposes that the majority of teachers are enthusiastic about trying new technologies. The report shows that 24% of the respondents showed that they are "risk takers" who are willing to try new technologies even if they may be unsuccessful. In addition, 47% said they enjoy working with new digital tools not yet generally used in the classroom (Technology Counts, 2016). Conversely, when respondents were asked to measure how prepared their students are to use educational technology for specific activities, the teachers gave higher ratings to routine practices such as drills, practice exercises, and assignments in reading than to more complex projects such as using social media to collaborate and create original content (Technology Counts, 2016). Similarly, responses indicated that educators were far more likely to say that their students use technology daily for drills and review activities rather than for project-based or collaborative activities (Technology Counts,

2016).

According to the report, these findings echo preceding research showing that despite an increase in technology in schools, many teachers still mainly rely on digital programs to enhance traditional instructional strategies instead of using technology to incorporate more creative, inquiry-based learning. Furthermore, the results suggest that digital learning is in some form imbedded in many classrooms and that a momentum toward new classroom practices is present (Technology Counts, 2016).

Regarding the number of technological devices, respondents indicated that having too few devices and a lack of professional development regarding technology in the classroom remain barriers to regular use of technology in the classroom. Wireless-connectivity problems and computer breakdowns were also a problem, as respondents reported these issues occur frequently (Technology Counts, 2016). When asked about professional development regarding technology in the classroom, respondents reported the need for information on how to better integrate technology into their daily instruction. They also mentioned idea sharing with other teachers as well as collaborative planning time and job-embedded training as offerings that would be beneficial to them regarding technology integration into instruction (Technology Counts, 2016). Appendix A displays data from the 2016 survey.

To support the idea that differentiation is necessary when using technology, Stanford et al. (2010) wrote about challenges for teachers today in the area of differentiation of instruction, focusing on the benefits of technology as a tool to differentiate. According to Stanford et al.,

> In order for teachers to reach ALL students, teachers must begin where students are, which means recognizing individual differences. Differentiated instruction

> (DI) with the use of technology offers the opportunity for teachers to engage students in different modalities, while also varying the rate of instruction, complexity levels, and teaching strategies to engage and challenge students. Differentiated instruction also allows teachers to begin to think and work "smarter" and more efficiently rather than trying to work harder to meet the needs of such a diverse student population. (p. 2)

Stanford et al. (2010) said that during the current era of high stakes testing and accountability, teachers encounter more demands and still limited time and resources. Opportunely, the increase of technology allows teachers to modify curricula to individual student needs quickly and effectively (Stanford et al., 2010). Stanford et al. said that technological resources such as Excel, PowerPoint, word-processing with built-in spelling and thesaurus features motivate students and allow them to work more independently while also giving them the opportunity to gain valuable real-world skills. Stanford et al. stressed that these technological resources are important and available to teachers. Harnessing the potential of technology in our classrooms is the key to unlocking the benefits of using technology with students (Stanford et al., 2010).

Summary

Differentiation has been explored by many researchers and practiced in many classrooms. Learning to differentiate implementing that knowledge in the classroom allows for an environment where all students can learn (Tomlinson, 2003). This chapter addressed the definition of differentiated instruction by providing key terms and definitions. It also provided a history of differentiated instruction and gave objectives and principles of differentiated instruction.

In Chapter 3, methodology is discussed in detail. This discussion includes a restatement of the problem, a description of the quantitative and qualitative data collected and the sufficiency of the data to answer the research questions, a description of the site and participants, and a description of the procedures for collecting and analyzing the data.

Chapter 3: Methodology

Restatement of the Problem

As stated in previous chapters, the researcher acknowledges the differing learning styles of students. Tomlinson (2014) stated, "In every classroom, no matter the degree of homogeneity, students will inevitably represent a significant range of readiness variance, a broad spectrum of interests, a full complement of approaches to learning, and quite different motivations to learn" (p. 35). Tomlinson (2014) went on to say that many students today come from homes where there is a lack of academic support including resources and time. This problem coupled with the recent growing number of technologies available to teachers and students creates a gap in knowledge about how teachers are using technology in the classroom and if differentiation is occurring when technology is used (Smith & Throne, 2007). Smith and Throne (2007) said that the power of differentiated instruction and technology together "will soon be apparent to teachers who successfully use technology in a differentiated environment. Technology is a highly motivating interactive tool that can be used to personalize students' instruction according to their learning styles, interests, and readiness" (p. 13). Survey results determine that students are innovative users of technology and they use technology to support their learning styles and lifestyles (Project Tomorrow, 2015). Recent research does not provide enough information on whether teachers are combining technology with differentiated instruction. This study was designed to shed light on the topic and to determine any significant differences between teacher reports of differentiation used and observed differentiation use. It also examined the role that technology plays in differentiated instruction in a rural, southeastern school district setting. The researcher's purpose in conducting this study was to answer the following research questions.

1. What is the association between teacher reports of differentiation use and observed differentiation strategies used?
2. How are teachers using the differentiation strategies of which they are aware when planning and implementing lessons that involve technology in the areas of content, process, product, and learning environment?

Methodology Description

This study was a mixed-method study in which both quantitative and qualitative data were collected. Qualitative data were collected in the form of classroom observations and interview questions. Quantitative data were collected using a questionnaire (Hobson, 2008) that has been used and validated in two previous studies regarding differentiation. The questionnaire has an open-ended question that allowed the researcher to collect qualitative data using this tool. This area provided the researcher with qualitative information. Regarding observations, an observation form was used. This form collected both quantitative and qualitative data as it includes a section for notes as well as a checklist. The following discusses the qualitative and quantitative data collection instruments and methods in more depth.

Quantitative Data Collection

The quantitative instrument for collecting data consisted of a questionnaire titled Differentiation Practices Questionnaire for Classroom Teachers (Appendix B). It was taken from a study used by Hobson (2008) regarding differentiation in the year 2004 and again in 2008. The aim of Hobson's latest study was to find out (a) what differentiation strategies teachers use to address student characteristics in heterogeneously grouped classrooms at the middle school level, and (b) what educational or contextual factors influence teacher use of differentiation strategies in heterogeneously grouped classrooms

at the middle school level? The questionnaire used in these studies was adapted from a survey that Tomlinson (2000) used in a study titled Teacher/Peer Reflection on Differentiation Instrument. Permission was given to Hobson by Tomlinson (2000) for use of the instrument in this study. Before beginning research, the researcher reached out to Hobson for permission to use the questionnaire and observation checklist and permission was granted (Appendix C). After data were collected, they were disaggregated to determine a general occurrence of differentiation at the site (broken down into four areas: content, process, learning environment, and product) and a general representation of the presence of technology in differentiated lessons in K-5 classrooms in a rural southeastern county.

The Differentiation Practices Questionnaire for Regular Classroom Teachers is divided into two sections. Section I contains questions that are related to demographic information. The second section contains 40 items and deals with the use of differentiated instructional strategies by classroom teachers. The items concerning differentiation strategies are categorized as general differentiation, content differentiation, differentiation relating to the process strategies, the differentiation of student products, and differentiated instructional and management strategies (Hobson, 2008, p. 44). In Hobson's (2008) study, she reported no significant relationship between the demographics, experience, or professional development received and the extent with which teachers differentiated. Considering this, the demographic portion of the questionnaire was not used in this study.

The questionnaire includes two scales. The scale on the left reflects the knowledge and skill of the teacher regarding a differentiation strategy and the scale on the right deals with the frequency in which the teacher uses a differentiated strategy in the

classroom. Teachers responded to both scales. The teachers were asked to indicate whether or not they use the strategy and the frequency of which they use the strategy. They also indicated their perceived use of each strategy using a four-point scale: 1 = hardly ever; 2 = sometimes; 3 = more than half the time; 4 = almost always or always (Hobson, 2008).

After collecting questionnaire data, the researcher looked for significant statistical differences by running chi-square tests to compare questionnaire responses regarding use of differentiation and actual observed use of differentiation. These tests revealed any possible statistical significance regarding teacher reports of differentiation use and actual use. The questionnaire included an open-response portion at the bottom. The researcher used data from this section by entering it into QDA Miner Lite for qualitative purposes. Quantitative statistical testing was done using the online statistics tool, SSPS (Laerd Statistics, 2013). Urdan (2010) stated that the purpose of the chi-square test is that it "allows you to determine whether cases in a sample fall into categories in proportions to what one would expect by chance" (p. 161). It is a test of association and tests for trends between two ordinal variables (Laerd Statistics, 2013). The chi-square test works by comparing categorically coded data that have been collected (known as observed frequencies) with the frequencies that the researcher expects to get (known as expected frequencies) and allows the researcher to determine whether the observed frequencies are significantly different form the expected frequencies (Urdan, 2010). A contingency table shows the comparison of expected and observed frequencies. The tables display teacher responses regarding frequency of differentiation use as well as the frequency of observed use collected using the Observation Checklist.

As with any research, the tools used must be valid and reliable. According to

Butin (2010), survey research is a common tool for gathering data; and if a researcher is using a survey that has already been validated and used in other studies, it may be extremely easy to make slight changes for other studies. This questionnaire was used twice before and was not changed from its previous form. The questions on this questionnaire are deliberate and explicitly connected to answering the researcher's questions which, according to Butin, make for a good survey that "follows a standard protocol" (p. 92). Butin went on to say that "research questions should be informed by your literature review which will determine how you ask a particular question" (p. 92).

Qualitative Data Collection

In addition to quantitative data, there were also instruments for collecting qualitative data in this study. The researcher used an observation form taken from Hobson (2008) who based the form on one of Tomlinson's (2000) observation instruments in an earlier study. Hobson selected 18 of the 40 items from the Differentiation Practice Questionnaire mentioned above. Hobson felt that these items were the most easily observed differentiated practices to include on the observation form. Hobson felt that "having a limited number of items (differentiation practices) to look for made the observation of data within the 20-minute classroom visit more plausible, and also allowed the recording of data between observations to be more efficient" (p. 25). The researcher added a column to the form wherein technology was noted during observations and later coded using QDA Miner Lite.

To check for validity and reliability of this instrument, Hobson (2008) had three teachers review each item on the questionnaire and observation instrument to make suggestions for improvement as well as suggestions for improving the clarity of the items. Recommended changes were made by Hobson to each instrument. For the

purposes of this study, the researcher chose to add a column to the Observation Checklist which was used to check if technology was used to differentiate in a specific area and to take field notes about technology use. The researcher also identified two areas in the observation form which contained only three observable instructional activities. The researcher felt that these two areas should contain the same amount of opportunities to be observed during the observation; therefore, two items on the observation forms were changed to remedy this. The researcher had three teachers review the updated observation for suggestions to check for validity and reliability. The updated form can be viewed as Appendix D. Participants included 12 teachers, and observations occurred in each of the two classes per grade level (K-5). According to Butin (2010), "field observations are extremely useful for emergent designs that are exploratory in nature and that require a holistic and layered levels to a research situation" (p. 100). Butin went on to say that observations are a "wonderful way to crosscheck data gathered by other means" (p. 101). In this specific study, the observations conducted served as a way to cross-check data from interviews and surveys. Field observations were time intensive and the least quantifiable way of collecting data. Interviews were also rewarding in terms of collecting data that is rich (Butin, 2010). After conducting field observations, the researcher compared the results to determine any significant statistical differences between what was reported by the teachers on the questionnaire and what was observed by the researcher during observations. The qualitative portion of these observations came from observation notes taken during the observations. These were coded using an online qualitative data analysis tool, QDA Miner Lite.

The second piece of qualitative data that the researcher collected was data from interview questions. These questions were compiled using statements from the

observation form and questionnaire items. Many of the interview questions involved asking teachers about the use of technology in order to establish any possible themes between the three data points. Interview questions were asked to a focus group of teachers participating in the observation and questionnaire portion of the study. Butin (2010) said that focus interviews are a concrete and simple way to collect data from relevant individuals. Butin also stressed the importance of aligning research questions to interview questions and the importance of asking open-ended questions that elicit meaningful and deep responses by stating that

> you want them to talk about their experiences, their feelings, and their intuitions surrounding the issue you are examining. Your job, as a researcher, will be to later transcribe and analyze the data, searching for patterns, themes, and distinctive perspectives. (p. 97)

As with the quantitative tools, qualitative tools must be valid and appropriate. Butin (2010) discussed how interviews are concrete and simple ways of collecting important data that are relevant to individuals in a way that is both effective and controlled. There are two main types of interviews: one-on-one and focus groups. For purposes of this study, focus interviews were conducted. Butin said that "alignment of research questions to interview questions and the need for neutral phrasing" is key (p. 97). Considering this, the researcher used statements from the observation form and the questionnaire to create the interview questions. The researcher also referred to the research questions when creating each interview question. There were serval questions regarding the use of technology during lessons, as this data collection tool helped answer the second research question regarding technology use and differentiation. The interview questions were asked after the observations were complete to avoid any response bias.

Butin said that it is important to consider potential sources of bias and to carefully structure interview protocol to avoid bias responses. The questions were also open-ended questions in order to elicit deep and meaningful responses instead of "yes" or "no" responses (Butin, 2010).

Sufficiency of Instruments to Answer Research Questions

The following table displays each research question and shows how each data collection tool answered each research question. Creswell (2014) discussed three forms of validity that should be present when using an instrument for data collection: content validity (does the instrument measure what it says it will measure); predictive or concurrent validity (do results correlate with other results); and construct validity (do items measure theoretical constructs or conceptions; p. 160)? In order to check the reliability of participant responses, the researcher asked teachers to check their responses for agreement. Creswell said that validity is a strength of qualitative research and is based on determining whether findings are accurate from the standpoint of the researcher, the participant, or the readers of an account. Creswell also described the use of peer debriefing to enhance the accuracy of the observed account. This includes finding a person to peer debrief with about the qualitative study so the account will resonate with people other than the researcher. This person was an outside peer with no personal ties to the research or the participants. It involved the peer viewing materials such as notes, documents, and recordings to look for over or underemphasized points, vague descriptions, or general errors. This strategy was used by the researcher to add validity to the observation accounts (Creswell, 2014).

The questionnaire used contained 40 questions about differentiation in the classroom and can be viewed as Appendix B. It has been used twice before, once by

Tomlinson (2000) and later by Hobson (2008). The questionnaire collects both quantitative and qualitative data, as it has a portion for open response by the participant at the bottom of the form. Table 1 displays each research question along with the instrument used to collect data sufficient to answer the research question and the way in which each section of data was analyzed.

Table 1

Alignment of Research Questions to Instruments and Data Analysis Tools

Research Questions	Instrument	Data Analysis
1. What is the association between teacher reports of differentiation use and observed differentiation strategies used?	-Questionnaire -Observation Checklist	-Chi-Square -Chi-Square
2. How are teachers using the differentiation strategies of which they are aware when planning and implementing lessons that involve technology in the areas of content, process, product, and learning environment?	-Observation Checklist -Focus Group Interview Questions	-Open Coding and Chi-Square -Open Coding

Research Context/Site

This study took place in a rural southeastern school district which is a rural county in North Carolina. The county's website asserts that it will empower all students to compete worldwide and will provide a safe, active, and globally competitive educational environment where students can reach their full potential. The county currently has 25 schools and is comprised of 15 elementary schools, four middle schools, four high schools, one Early College school, and one alternative school. There are currently 13,179 students enrolled across the county. This student population is made up of approximately 62.5% White students, 20.2% African-American students, 11.4% Hispanic students, 5%

multi-racial students, .5% Asian students, and .4% American-Indian students.

The specific site where the research was conducted is a rural elementary school located in the northeastern part of the county. This site is not the school in which the researcher works. The researcher purposely chose not to conduct research at her own site in order to avoid researcher bias. This school is referred to as School A in this study. This is a school that houses one principal, one prekindergarten classroom, two kindergarten classrooms, two first-grade classrooms, two second-grade classrooms, two third-grade classrooms, two fourth-grade classrooms, and two fifth-grade classrooms. The school also has one self-contained Exceptional Children's teacher, two other Exceptional Children's teachers, and two Exceptional Children's assistants. In addition, there are five specials teachers, one Curriculum/AIG Specialist, and one guidance counselor within the school. According to the school's website, the school's mission is to give students quality instruction and to inspire lifelong learning by providing students with a safe environment, technology, a high level of conduct, the promotion of diversity, and encouraging parental and community involvement. The school's website also states that the school staff is committed to using technology daily, modeling good conduct and citizenship, accepting and encouraging diversity, encouraging community and parental involvement, and providing an atmosphere conducive to learning. School A is a Title I school, which means they receive additional money from the government to be used to meet the needs of students.

Participants

The researcher conducted field observations in 12 classrooms at the described site. This sample size was chosen for convenience, considering this study was only conducted at one site and there were 12 teachers total in Grades K-5 at the site. There

were two teachers per grade level at School A. The teachers in the classrooms were all certified teachers. The observed teachers were informed of the four unannounced 30-minute observations within the dates given on the timeline in Figure 1. The participants were asked to sign consent forms created by the researcher. Teachers were also informed that the study would be completely anonymous and that no school, teacher, or student names would be used in the study.

A focus group of teachers from School A was interviewed. The focus group consisted of the 12 teachers participating in observations. Creswell (2014) said that interviews are useful because they provide the researcher with historical information and the researcher has some control over the line of questioning.

In addition to those participating in observations and interviews, the differentiation questionnaire was given to the teachers participating in the observations and focus group. This is because the questionnaire responses regarding frequency of use were compared to observation checklist data. This is also due to convenience. Urdan (2010) said that convenience sampling is common and involves the researcher selecting participants based on proximity and ease of access. In this case, the 12 teachers participated in all three pieces of data collection. Getting questionnaire data from these specific participants allowed the reports of these teachers from the questionnaire to be appropriately compared to actual observed accounts.

Procedures

Data collection. According to Creswell (2014), "data collection steps include setting the boundaries for the study, collecting information through unstructured or semi structured observations and interviews, documents, and visual materials, as well as establishing the protocol for recording information" (p. 189). The site chosen for

observations was purposely selected because it is an elementary school, and the research questions specifically seek to determine differentiation and technology use at the elementary level. As previously mentioned, the participants for the interviews were the same as the participants for the observations. This is because of convenience. With regard to the questionnaire, the participants were also the same in order to accurately compare responses to observation data so a chi-square could be used to analyze data. The questionnaire was given to teachers electronically via Survey Monkey.

To conduct this research, the candidate contacted both the Superintendent, the Assistant Superintendent, and the District Director of Testing and Research to make them aware of what research the candidate intended to conduct. District leaders were helpful in providing the candidate with instruction on how to proceed with research and approved the data collection tools and site (Appendix E). The principal at School A (observation site) agreed to allow observations to be conducted. The teachers at School A gave their permission to participate by signing a consent form (Appendix F).

Regarding the frequency of data collection, the researcher observed each participant four times during the research window, which was approximately one month in length. Each observation lasted 30 minutes. The questionnaire was given to the participants electronically. Participants who did not complete the questionnaire within the first week were resent the questionnaire link and reminded to respond. All 12 participants responded to the questionnaire. Questionnaire data were collected first, followed by observational data. The interviews were conducted at the end of the observation period so the questions asked by the researcher did not influence observable teaching behavior. The following is the timeline for data collection.

1. Questionnaire: April 20-April 28

2. Observational Data: May 1-June 1
3. Interview Data: June 2

Observational data were recorded in the form of a checklist that allowed the observer to indicate what types of differentiation occurred during the observations and whether technology was involved. Interview responses were recorded on a hard copy of the interview question form. The researcher took thorough notes during the interviews. Questionnaire data were collected electronically and disaggregated using SSPS (Laerd Statistics, 2013). The researcher collected data within a 1-month time (approximate) frame.

Data analysis. This study involved the researcher collecting data using three data points: interviews, observations, and a questionnaire. Data were collected using these tools and were analyzed using SSPS (Laerd Statistics, 2013) and QDA Miner Lite, which is an online qualitative data analysis tool. Data analysis using these tools aided the researcher in identifying themes, providing the researcher with triangulation. It also revealed any significant statistical differences between teacher reports of differentiation use and actual use. According to Urdan (2010), using a chi-square test will permit the researcher to determine if cases in a sample fall into categories that are equal to what one would expect. This type of research does not require the researcher to manipulate anything; instead, the researcher collects data on several variables and then conducts statistical analyses to determine how strongly different variables are related to each other (Urdan, 2010). In this study, the researcher collected data and analyzed the data to identify themes. The occurrence of technology during differentiated instruction was also examined using open-coding through the QDA Miner Lite qualitative analysis program.

For quantitative data analysis purposes, the researcher disaggregated data from

the questionnaire results. Creswell (2014) described steps in analyzing quantitative data. These steps include reporting descriptive statistics calculated (means, standard deviations, and ranges); indicating the statistical tests used to examine the hypotheses in the study; and using graphs and representations to organize and display results (Creswell, 2014). Conclusions were drawn from the data that were analyzed using SSPS (Laerd Statistics, 2013), which allowed the researcher to identify statistical significances. The researcher analyzed the questionnaire responses by using chi-square tests to look at differentiation factored by reported frequency of use and observation of use.

For qualitative purposes, observational data and interview data were coded to identify themes and patterns. Qualitative data analysis mainly involves classifying things, persons, and events, and the properties which characterize them (Creswell, 2014). Creswell (2014) described the steps in analyzing qualitative data. These steps include organizing and preparing data for analysis, reading and reviewing all of the data, and coding the data (Creswell, 2014). QDA Miner Lite is a computer-assisted data analysis software program that assisted the researcher in doing just that. The program uses advanced artificial intelligence to enable coding and analysis. QDA Miner Lite analyzes a variety of forms of data including video, html, graphics, and audio files.

By using three data collection tools and analyzing three data points, the researcher triangulated these different data sources of information. This allowed the researcher to build a clear defense for themes. "If themes are identified based on converging several sources of data or perspectives from participants, then this process can be claimed as adding to the validity of the study" (Creswell, 2014, p. 201). Qualitative data were collected, analyzed, and described in detail. Creswell (2014) said that when this happens, "the results become more realist and richer. This procedure can add to the validity of the

findings" (p. 202).

Summary

Chapter 3 explained the methodology of this study including qualitative and quantitative tools used for data collection as well as data collection and analysis procedures. The sites and participates were also described as well as a rationale for the methodology of this study. The procedures and tools sufficiently measure the research questions posed by the researcher.

Chapter 4: Results

Restatement of the Problem

As stated in preceding chapters, the researcher recognizes the differing learning styles of students. According to Tomlinson (2014), "In every classroom, no matter the degree of homogeneity, students will inevitably represent a significant range of readiness variance, a broad spectrum of interests, a full complement of approaches to learning, and quite different motivations to learn" (p. 35). Many students come into classrooms today from homes where there is a lack of academic backing such as resources and time (Tomlinson, 2014). This problem, joined with the recent growing number of technologies available to teachers and students, generates a gap in knowledge about how teachers use technology in the classroom and if differentiation is occurring when technology is used (Smith & Throne, 2007). Technology, according to Smith and Throne (2007), is a highly encouraging cooperative tool that can be used to personalize student education according to their learning styles, interests, and readiness. In addition, survey results show that students are advanced users of technology, and they use technology to support their learning styles and lifestyles (Project Tomorrow, 2015). Recent research does give enough evidence to show that teachers are combining technology with differentiated instruction. This study's intention was to shed light on the topic and to determine any association between teacher reports of differentiation used and observed differentiation use. It also looked at the role technology plays in differentiated instruction in a rural, southeastern school district setting. The researcher's purpose in conducting this study was to answer the following research questions.

1. What is the association between teacher reports of differentiation use and observed differentiation strategies used?

2. How are teachers using the differentiation strategies of which they are aware when planning and implementing lessons that involve technology in the areas of content, process, product, and learning environment?

Chapter Overview

This chapter presents the findings of the data analyses and graphically displays the findings. This chapter contains results from the questionnaire, observations, and focus interview questions; and the results are addressed for each individual research question. The findings presented in this chapter drive recommendations offered in Chapter 5.

Results

The results of this study are displayed and discussed below for each specific research question. This study used both quantitative and qualitative forms of data collection including a questionnaire, field observations, and focus interview questions (Appendix G). The following explains data findings for both Research Question 1 and Research Question 2.

Research Question 1

The first question this study aimed to answer involved teacher reports of differentiation use and the actual observed use of differentiation strategies. The first research question was, "What is the association between teacher reports of differentiation use and observed differentiation use?" This question was answered with data from the Differentiation Questionnaire and the Observation Checklist. The questionnaire was given as the first tool for collecting data and was administered electronically using Survey Monkey. This questionnaire was sent to the 12 teachers participating in the study via email. After approximately two weeks, each teacher had completed the

questionnaire. Observational data were collected using the Observation Checklist and were conducted over a 3-week time frame, beginning the first week of May. Each participant classroom was observed by the researcher four times for 30 minutes each.

Quantitative Data

In order to find associations between teacher reports of differentiation use and actual use, the questionnaire and the observation data were compared using chi-square analysis. According to Urdan (2010), chi-square testing allows the researcher to determine whether observed frequencies are significantly different from expected frequencies. In this study and in the chi-square tests presented below, there were two categories: observed and reported. The observed category referred to the frequency of observed differentiation use. The reported category referred to teacher reports of differentiation use (taken from the questionnaire). Both the Observation Checklist and the Questionnaire contained the four sections Tomlinson (2014) spoke of regarding effective differentiation: content, process, learning environment, and product. Considering this, the researcher conducted chi-square tests in each of those four areas of differentiation. The Observation Checklist, as mentioned in previous chapters, consists of 18 questions. These questions correlate with 18 of the questions on the questionnaire. These are the 18 questions that were compared using chi-square analysis. Table 2 displays data in the area of content and addresses five of the 18 questions. Table 3 displays data in the area of process and addresses five of the 18 questions. Table 4 displays data in the area of learning environment and addresses four of the 18 questions. Table 5 displays data in the area of product and addresses four of the 18 questions. The following tables show an analysis of reports of teacher use of differentiation and observed use of differentiation broken down into the four areas of differentiation.

For each analysis, a significance level of .05 was used. If p values from these chi-square analyses were less than .05, that would indicate no significant difference between teacher reports of differentiation use and actual observation of differentiation use since the null hypothesis assumes there is no association between the two. If the p values in these assessments were less than the chosen significance level (.05), that would suggest that the observed data are sufficiently inconsistent with the null hypothesis and the null hypothesis may be rejected (Urdan, 2010). In this study, if p values were less than .05, there would not be a significant difference in teacher reports of differentiation use and observed differentiation use. In each area (content, process, learning environment, and product), the chi-square p values using the data from this study were greater than .05 and, therefore, not significant. This means that although teacher reports of differentiation use were higher than observed use, the level of significance was not enough to reject the null hypothesis. The following contingency tables display data in each area of differentiation accompanied by descriptive narrative to explain the results for each area.

Table 2

Chi-Square Analysis: Content

	Content Q1	Content Q2	Content Q3	Content Q4	Content Q5	Row Totals
Observed	4 (3.27) [0.16]	4 (3.73) [0.02]	1 (1.87) [0.40]	3 (2.80) [0.01]	2 (2.33) [0.05]	14
Reported	3 (3.73) [0.14]	4 (4.27) [0.02]	3 (2.13) [0.35]	3 (3.20) [0.01]	3 (2.67) [0.04]	16
Column Totals	7	8	4	6	5	30 (Grand Total)

Note. The chi-square statistic is 1.2149. The p value is .875636. The result is not significant at $p < .05$.

Table 2 displays reported use of differentiation and observed use of differentiation in the area of content. This area involved curriculum differentiation in which curriculum design, teacher articulation, curriculum variation, material variation, and resource variation were examined. As seen in Table 2, three of the five questions involved a

slightly higher report of differentiation use than was observed. This difference, however, when entered into the chi-square calculator, was not significant enough to say that there was a significant difference in reported versus observed differentiation in the area of content. The p value in the area of content was .875636, meaning that the result was not significant.

Table 3

Chi-Square Analysis: Process

	Process Q6	Process Q7	Process Q8	Process Q9	Process Q10	Row Totals
Observed	2 (1.64) [0.08]	2 (2.05) [0.00]	1 (1.23) [0.04]	2 (2.05) [0.00]	2 (2.05) [0.00]	9
Reported	2 (2.36) [0.06]	3 (2.95) [0.00]	2 (1.77) [0.03]	3 (2.95) [0.00]	3 (2.95) [0.00]	13
Column Totals	4	5	3	5	5	22 (Grand Total)

Note. The chi-square statistic is 0.2131. The p value is .994711. The result is not significant at $p < .05$.

As seen in Table 3, in the area of process, the p value is .994711. This means that although there were some instances of higher reports of differentiation in this area, the difference was not enough to reject the null hypothesis in this instance.

Table 4

Chi-Square Analysis: Learning Environment

	Learning Environment Q11	Learning Environment Q12	Learning Environment Q13	Learning Environment Q14	Row Totals
Observed	2 (1.79) [0.03]	1 (0.71) [0.11]	1 (1.07) [0.00]	1 (1.43) [0.13]	5
Reported	3 (3.21) [0.01]	1 (1.29) [0.06]	2 (1.93) [0.00]	3 (2.57) [0.07]	9
Column Totals	5	2	3	4	14 (Grand Total)

Note. The chi-square statistic is 0.4252. The p value is .934992. The result is not significant at $p < .05$.

In the area of learning environment, the p value is .934992. This means that in this area, teachers did not report enough of a difference in use compared with observed use for the results to be significant. In the area of learning environment, the null hypothesis cannot be rejected.

Table 5

Chi-Square Analysis: Product

	Product Q15	Product Q16	Product Q17	Product Q18	Row Totals
Observed	1 (1.14) [0.02]	1 (1.14) [0.02]	1 (0.86) [0.02]	1 (0.86) [0.02]	4
Reported	3 (2.86) [0.01]	3 (2.86) [0.01]	2 (2.14) [0.01]	2 (2.14) [0.01]	10
Column Totals	4	4	3	3	14 (Grand Total)

Note. The chi-square statistic is 0.1167. The p value is .989765. The result is not significant at $p < .05$.

As with the other areas of differentiation, the p value in the area of product was not significant. The p value for this area is .989765. This means that teacher reports of differentiation in this area are consistent with observed use.

In all four areas of differentiation, chi-square tests revealed that p values were not at a level that would allow the researcher to have an alternative hypothesis. In this case, the null hypothesis that there is no significant difference in reporting versus observation of differentiation use cannot be rejected.

After examining each area of differentiation regarding reported use and observed use, the researcher decided to use data from the questionnaire regarding teacher reports of knowledge of differentiation to conduct an additional chi-square analysis. The following chi-square analysis contingency table reveals no significant difference between the knowledge teachers reported regarding differentiation strategies and the frequency of use of differentiation strategies that teachers reported. This table was created using both the left and right side of the questionnaire and compared teacher reported differentiated knowledge to teacher reported use of differentiation strategies. The categories in the contingency table are labeled as Level 1, Level 2, Level 3, and Level 4. This is because each section of the questionnaire allowed the teacher to rate themselves from 1 to 4. In the area of knowledge of differentiation, these ratings ranged from Level 1 (I don't understand what this means and don't know how to do it) to Level 4 (I thoroughly

understand what this means and fell adept at doing it). Regarding frequency of use, ratings ranged from Level 1 (Hardly ever use) to Level 4 (Almost always or always use). In this specific analysis, data from the entire questionnaire (40 questions) were used in contrast with the tests run in the four specific areas of differentiation comparing reported use to observed use. Table 6 shows chi-square results that are not less than .05; therefore, there is no significant difference in teacher reports of knowledge of differentiation and teacher reports of use of differentiation.

Table 6

Knowledge Compared to Reported Use

	Level 1	Level 2	Level 3	Level 4	Row Totals
Use	45 (47.43) [0.12]	158 (155.27) [0.05]	185 (195.36) [0.55]	62 (51.94) [1.95]	450
Knowledge	39 (36.57) [0.16]	117 (119.73) [0.06]	161 (150.64) [0.71]	30 (40.06) [2.52]	347
Column Totals	84	275	346	92	797 (Grand Total)

Note. The chi-square statistic is 6.1276. The p value is .105562. The result is not significant at $p < .05$.

In addition to the chi-square analyses above, averages of the reported amount of usage were calculated and compared with the average amount of times specific differentiation strategies were observed during field observations. Furthermore, the percentage of reported knowledge of these strategies were also calculated and compared to reported use and actual use. These comparisons can be seen in the figures below.

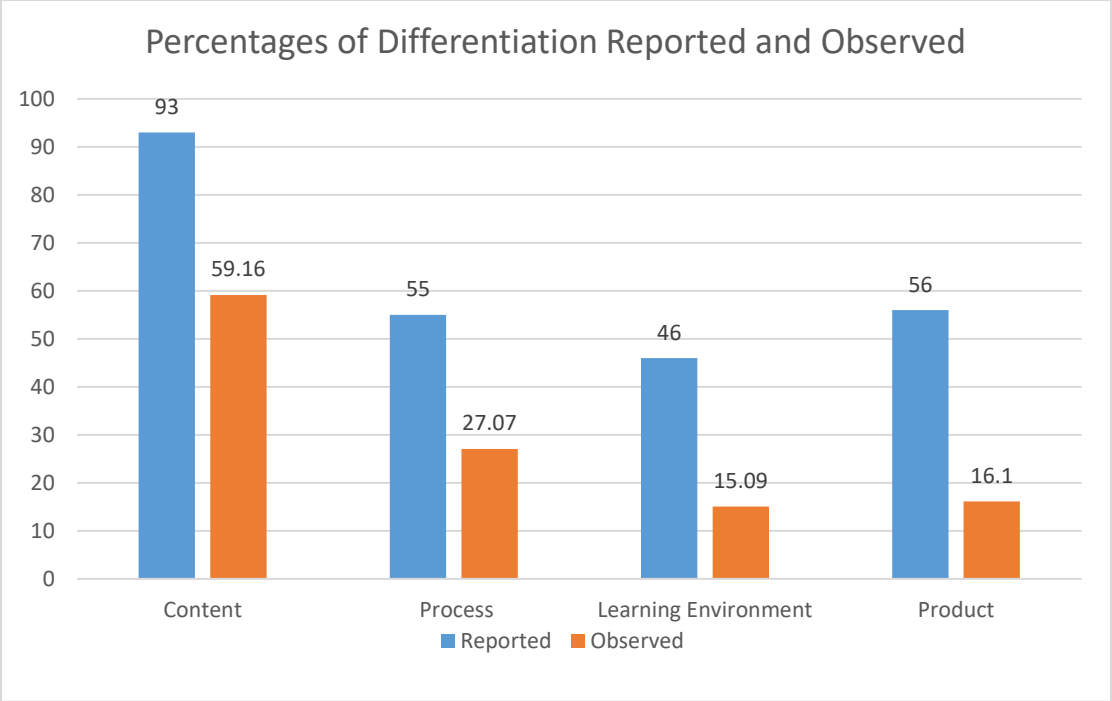

Figure 1. Percentages of Differentiation Reported and Observed.

According to the data displayed in Figure 1, teachers reported using differentiation strategies most often in the area of content. This was also true when the teachers were observed. When observed, teachers used differentiation strategies in the area of content most often. Likewise, teachers were observed and reported using differentiation strategies in the area of process as the second most common area of differentiation. Furthermore, the area of product was the third most common area of differentiation when teachers were observed and reported, and the area of learning environment was the least reported and observed area of differentiation. This means that just as the chi-square tests in the four areas of differentiation revealed, teachers consistently reported using differentiation in the same areas in which they were observed. Table 7 shows the reported knowledge that teachers disclosed on the questionnaire. The

table shows that teachers reported feeling most comfortable differentiating in the area of content; and teachers reported knowing how to differentiate mostly in the area of content, followed by product, process, and last, learning environment. Again, it is apparent that teachers reported being most knowledgeable about how to differentiate in the area of content and least knowledgeable about how to differentiate in the area of learning environment.

Table 7

Reported Knowledge of Differentiation Strategies

Area of Differentiation	Percentage Reported of Knowledge of Strategy
Content	63.6
Process	36.6
Learning Environment	33.3
Product	43.7

Research Question 2

In addition to finding any association between teacher use and reported use of differentiation, this research aimed to answer a second question; how are teachers using the differentiation strategies of which they are aware when planning and implementing lessons that involve technology in the areas of content, process, product, and learning environment? In order to answer this research question, the researcher used qualitative data in the form of the open-ended question on the questionnaire, notes taken from field observations, and focus interview questions. These qualitative data were collected then analyzed using open-coding through QDA Miner Lite.

Qualitative Data from Questionnaire

When looking at the qualitative data separately, the following information was revealed by the open-ended comments from the questionnaire, field notes, and focus interview questions. First, the researcher entered comments from the open-ended

question on the questionnaire into the QDA Miner Lite program. Figure 2 shows that teachers mentioned differentiation most often in the area of process. Furthermore, teachers expressed both a need for training in differentiation strategies and that they had already received training (both at 13%). Reponses to the open-ended questionnaire section indicated a frequency rate of 8.7% regarding technology being used to differentiate.

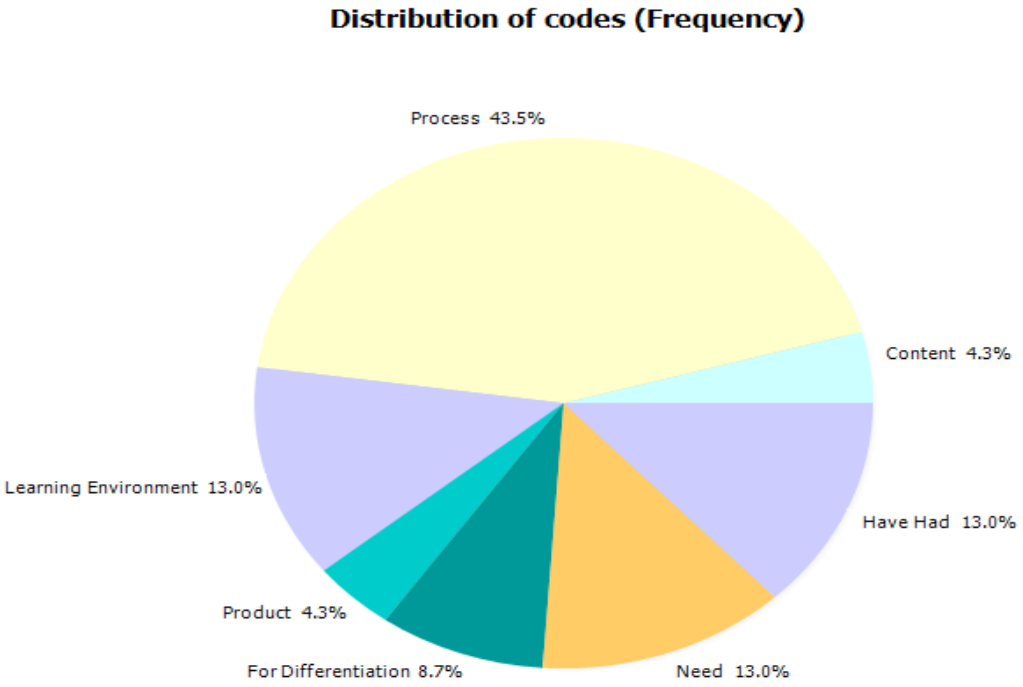

Figure 2. Distribution of Differentiation Codes.

Qualitative Data from Observation Field Notes

In addition to questionnaire qualitative data, field notes from classroom observations were analyzed using QDA Miner Lite. This analysis revealed that of the possible differentiated instructional strategies, there were several strategies that were used frequently across the board and several that were used rarely, if ever, across the board. According to Figure 3, there were seven strategies of which the frequency of use

was less than 5%. These include the use of tiered lessons (compacting, variation of challenge), tasks that vary from simple to complex, tasks that vary according to interest and learning profile, variation of learning pace, access to a range of resources and tools to create products, the opportunity to create a range of product alternatives, and the opportunity to create products that are based on real and relative problems. Of these seven strategies, one is located in the content area of the Observation Checklist, three are located in the process area of the checklist, and three are located in the product area of the Observation Checklist.

The data also showed that the three most frequently used strategies were the use of a variety of material and resources the area of content, the curriculum was based on major concepts and/or themes, and the practice of using clear articulation by the teacher. Each of these three practices are located under the content area of the Observation Checklist.

The remaining categories in the Observation Checklist fell between 6.7% and 9.1% of frequency. The chart below shows each area and the distribution of codes (frequency) according to the data collected and analyzed using QDA Miner Lite.

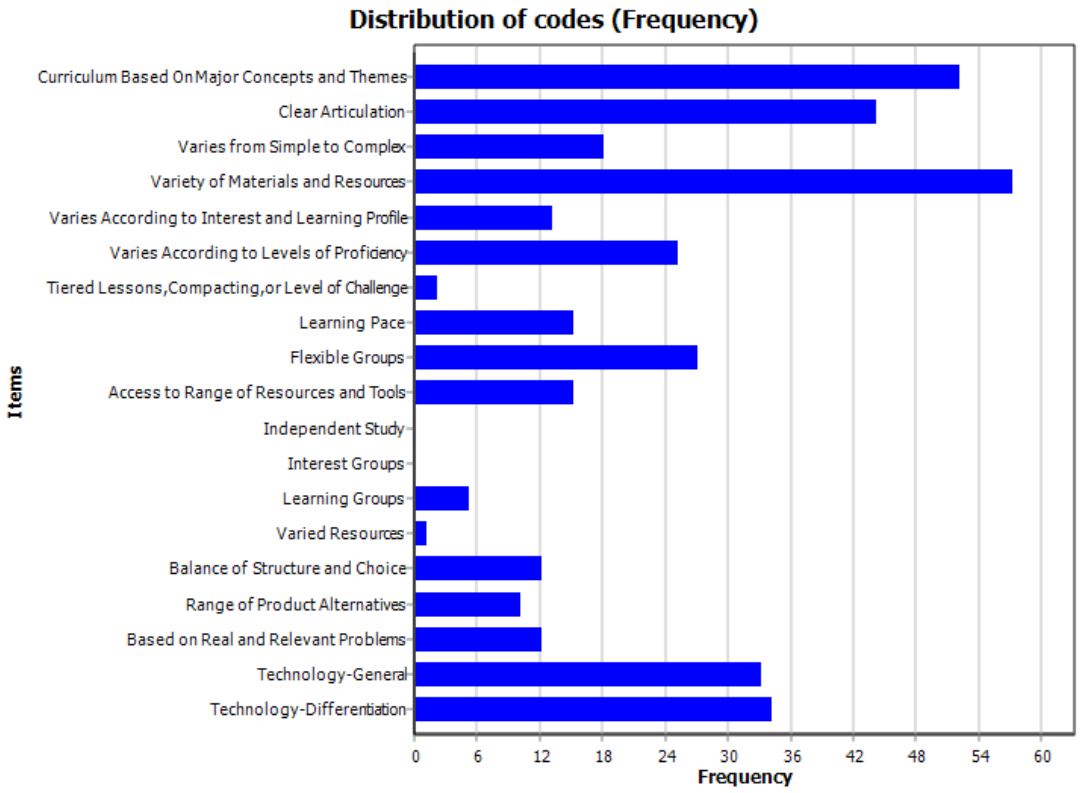

Figure 3. Distribution of Codes – All Areas of Differentiation.

When broken down into each area of differentiation (content, process, product, and learning environment), the researcher was able to see which strategies were observed more or less often during observations. Figure 4 shows that in the area of content, clear articulation, curriculum designed around a major concept or theme, and teacher provision of varying resources and materials were most frequently observed. In the area of process, the data showed that teacher variation of tasks that met student proficiency levels was frequently reported, along with the use of flexible grouping. In the area of learning environment, access to a range of tools and resources was most frequently observed. Last, in the area of product, a balance of structure and choice was most frequently observed along with the opportunity for students to solve relevant and real-life problems.

Across the board, when looking at differentiation as a whole, the strategies used

most often by the observed teachers were curriculum designed based on concepts and themes, clear articulation, and the use of a variety of materials and resources (in the area of content). Open-coding revealed that mention of these strategies appeared 40 or more times. Slightly below the use of these strategies, the use of technology was mentioned 30 or more times in the coding process. This includes technology for general purposes and technology for differentiation.

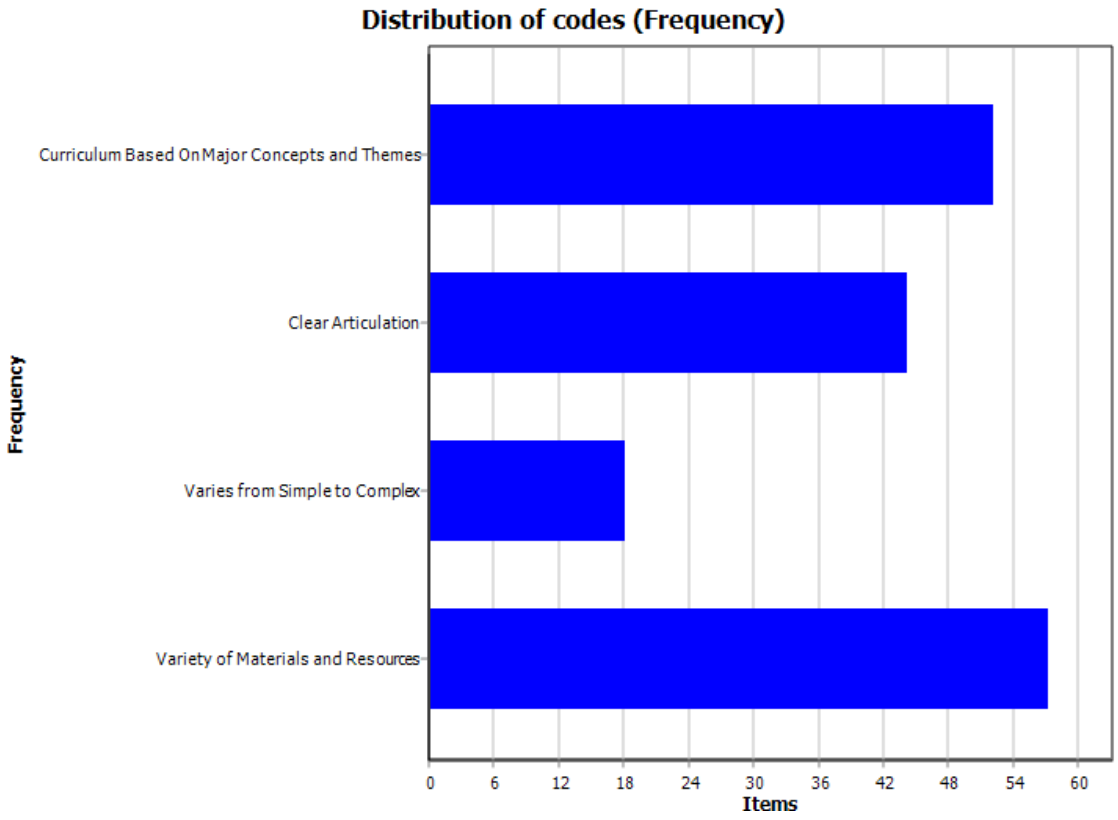

Figure 4. Distribution of Codes – Content.

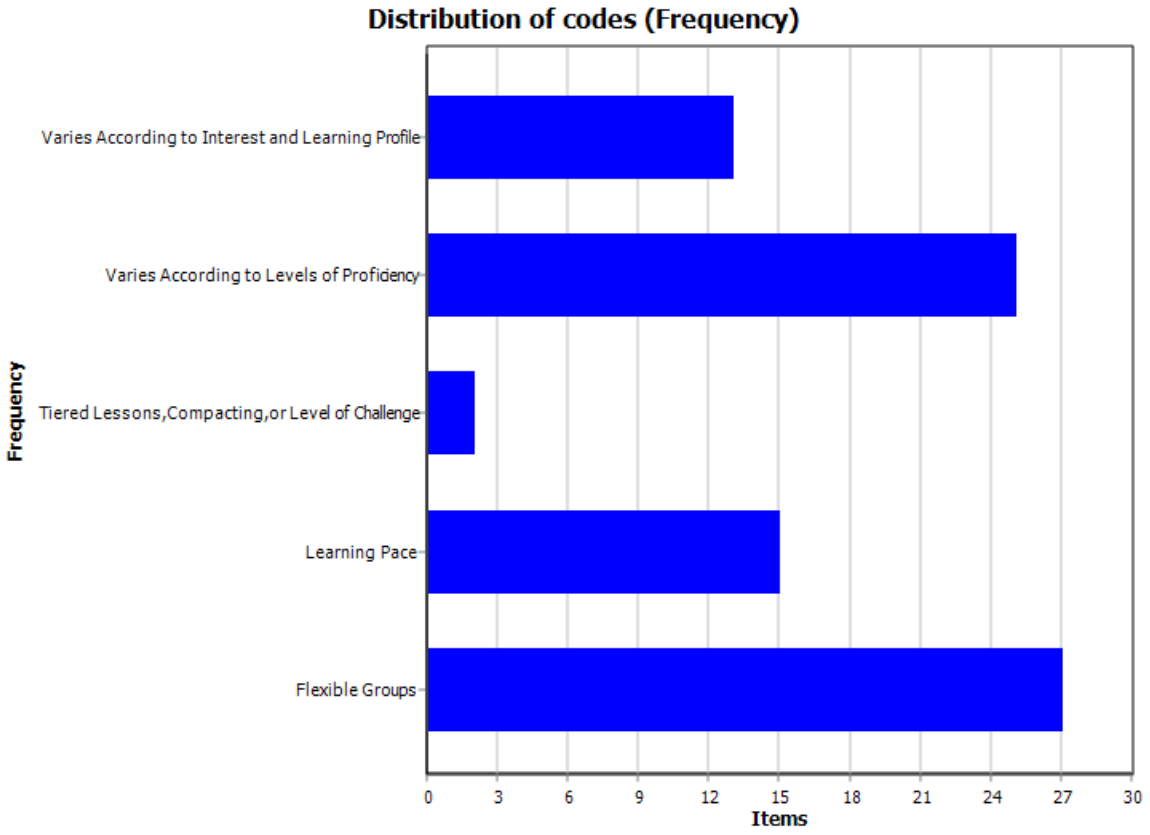

Figure 5. Distribution of Codes – Process.

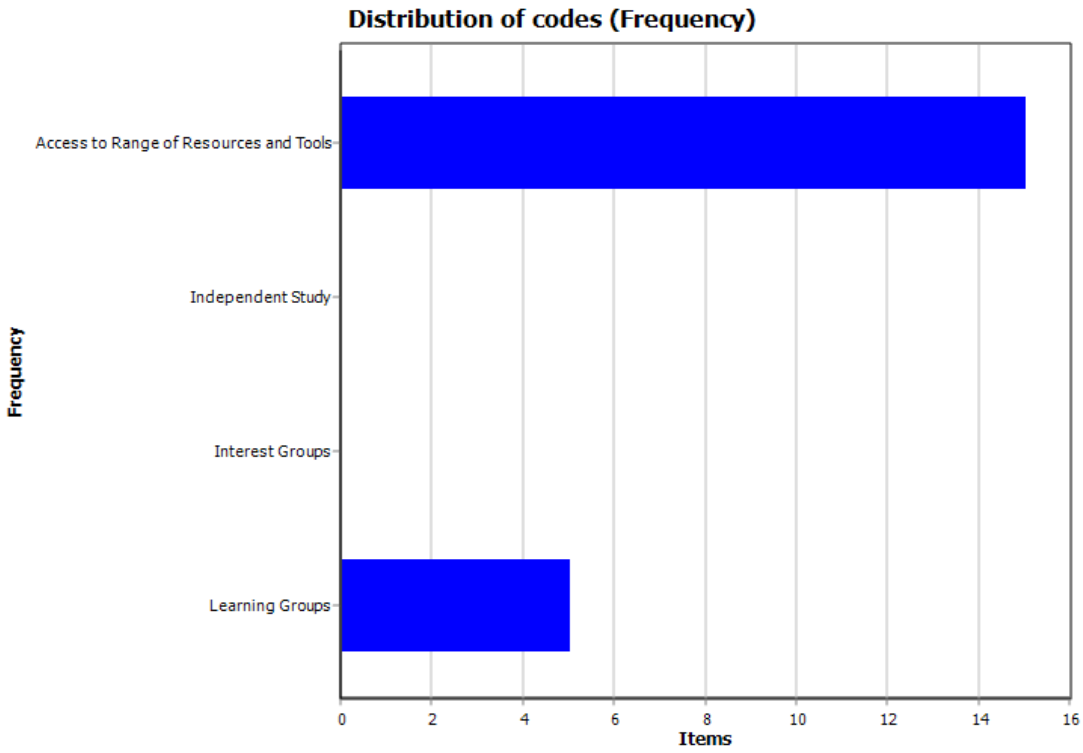

Figure 6. Distribution of Codes – Learning Environment.

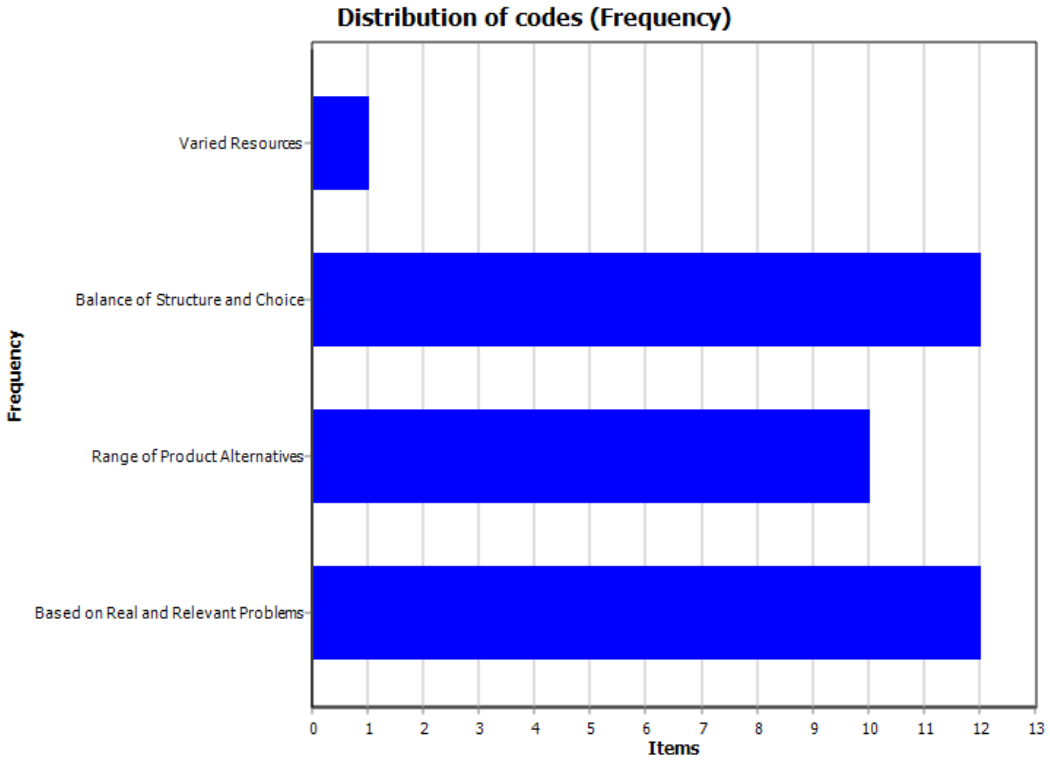

Figure 7. Distribution of Codes – Product.

Technology and Differentiation

Regarding the use of technology, the researcher used QDA Minor Lite to conduct open-coding in order to determine the occurrences of technology use in the areas of differentiation (content, process, learning environment, and product). Figure 8 displays the frequency of observed technology use in general and observed technology use for the purposes of differentiation.

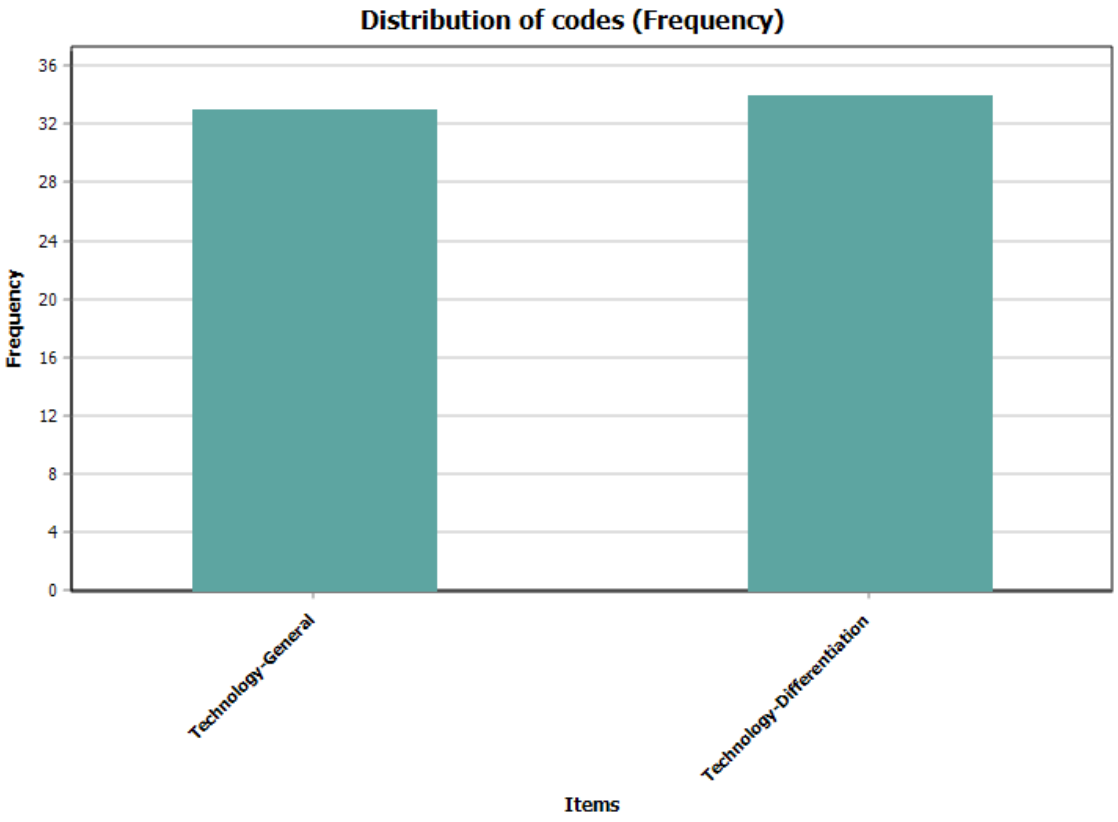

Figure 8. Distribution of Codes – Technology.

The data from open-coding using observational field notes showed that general technology use was observed slightly less frequently than technology use for differentiated instruction. Code percentages for technology use in general were 8.8% (33 cases), and code percentages for technology used for differentiation was 9.1% (34 cases).

When looking specifically at observed technology used for differentiation in each area of differentiation, the researcher found that there were 19 cases in which technology was used in the area of content, 14 cases in the area of process, four cases in the area of learning environment, and five cases in the area of product. Table 8 shows these data as well as data from interview questions which will be discussed later in this chapter.

Table 8

Technology Use Per Differentiation Area

Differentiation Area	Interview Question/ Technology Use	Field Notes/ Technology Use
Content	2	19
Process	2	14
Learning Environment	0	4
Product	0	5

The data from Table 8 show that in the areas of content and process, differentiated instructional strategies were used with technology more than they were in the areas of learning environment and product. This data trend can also be seen in Figure 9; as most differentiated strategies observed, using the notes section of the Observation Checklist, were in the areas of content and process.

When looking at open-coding data from interview questions, overall, there were four times when differentiation with technology and differentiation strategies occurred. The areas of content included two of these occurrences, and the area of process included the remaining two. Questionnaire open-coding data only revealed two overlapping instances of technology and differentiation. These took place in the area of process. Tables 9-11 show each of these qualitative areas of data collection and the results regarding the use of technology to differentiate.

In looking at the data from Tables 9-11, it is apparent that most differentiation using technology took place within the areas of content and process. This shows up in quantitative data as well as qualitative data.

Table 9

Field Note Open-Coding for Technology and Differentiation

Area	Overlapping Code Count	Themes
Content	19	10-Chromebooks, 5-Programs
Process	15	5-Chromebooks, 9-Programs
Learning Environment	4	2-Chromebooks, 2-Programs
Product	5	1-Lumens, 4-Program

Table 10

Interview Questions – Open-Coding for Technology and Differentiation

Area	Overlapping Code Count
Content	2
Process	2
Learning Environment	0
Product	0

Table 11

Questionnaire – Open-Coding for Technology and Differentiation

Area	Overlapping Code Count
Content	0
Process	2
Learning Environment	0
Product	0

Qualitative Data from Focus Interview Questions

In addition to the open-ended portion of the questionnaire and the observational field notes, qualitative data were also conducted using focus interview questions (Appendix G). These questions were answered by the 12 observed teachers in a group setting. As mentioned previously, these teachers were the same participants who participated in the questionnaire and observations. The answers given were entered into QDA Miner Lite for open-coding. The open-coding revealed that there were only two instances of differentiation using technology in the area of content and two in the area of

process (Table 8). Open-coding also revealed that the greatest occurrence of differentiated strategies belonged in the area of process (27.1%) as seen in Figure 9. There was also a significant mention of a lack of technology that would allow teachers to differentiate (22.9%). Furthermore, as evident in data from the observations and the questionnaire, the areas of learning environment and product had the least amount of occurrence.

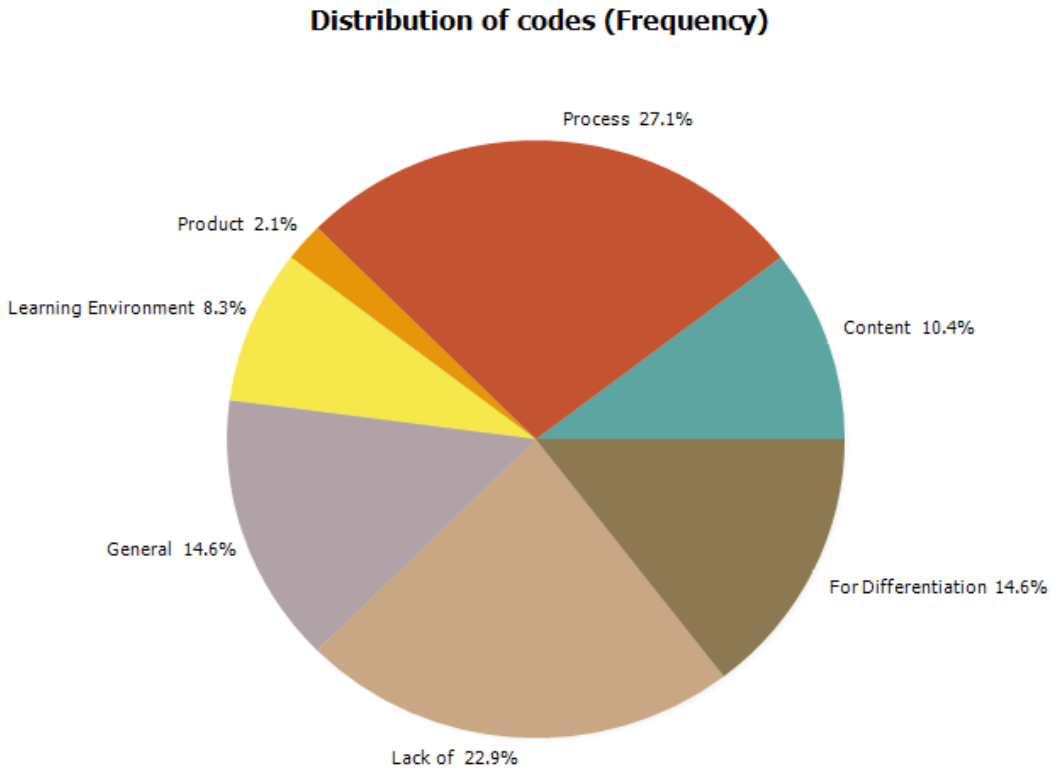

Figure 9. Distribution of Codes – Observation Field Notes.

Regarding the use of technology to differentiate, answers from focus interview questions were entered into QDA Miner Lite and the distribution of codes (frequency) can be seen in Figure 10. This chart shows the frequency of which teachers reported general use of technology, technology used for differentiation, and a lack of technology.

The chart below shows a percentage of 44.0 regarding a lack of technology. Many comments in the interview question session made clear that teachers felt they needed more resources in order to use technology to differentiate. One teacher in particuluar mentioned that she felt she needed more one-on-one technology so she could use the Chromebooks to differentiate. She said that she only has four Chromebooks but has 19 students and further stated that she usually uses technology whole group using her AcitivBoard. The chart below also shows that the percentages of the frequency of general technology use and differentiatied technology use were equal at 28%.

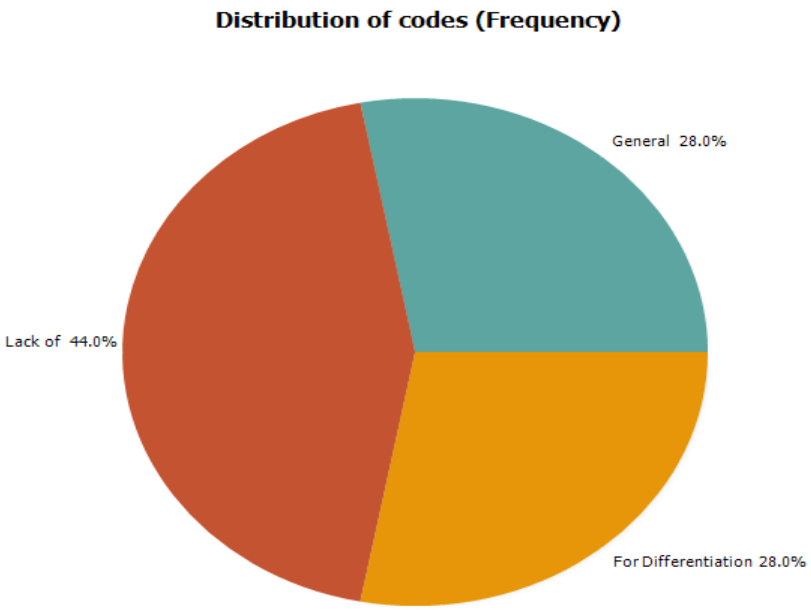

Figure 10. Disbritution of Codes – Focus Interview Questions (Technology).

Teacher responses to interview questions were valuable to the researcher as they provided firsthand accounts of teacher perspectives of differentiation and technology in the classroom. Table 12, seen in Chapter 5, displays responses from two participants. There were several similarities in these responses. Teachers A and B reported using

guided reading as a way to differentiate. These teachers also reported using programs that automatically differentiate for students (Achiev3000 and Smarty Ants). In contrast, Teacher A reported not having enough technology to provide students with one-to-one access. Teacher B reported using Chromebooks for interactive math games and other programs. The researcher acknowledges that the difference in the amount of technology could be due to the difference in grade level as Teacher A taught kindergarten and Teacher B taught Grade 4.

Summary

In summary, this chapter presents findings of data collected using a questionnaire, observations, and focus interviews. The data displayed and discussed above answer the following questions.

1. What is the association between teacher reports of differentiation use and observed differentiation strategies used?
2. How are teachers using the differentiation strategies of which they are aware when planning and implementing lessons that involve technology in the areas of content, process, product, and learning environment?

The data show that there is not a significant difference in teacher reports of differentiation use and observed differentiation use. They also reveal that most differentiation strategies used are those in the areas of content and process. Differentiation strategies are used least in the area of learning environment. Furthermore, the data show that many teachers report a lack of technology and that the frequency of general technology use and technology use for differentiational strategies are similar.

In Chapter 5, the data discussed and displayed in this chapter are reviewed. The data from this chapter informed the researcher in making recommendations based on the

researcher's findings. These recommendations are presented in Chapter 5, along with implications for the field of education and how the findings of this study support other study findings and theories.

Chapter 5: Conclusions

Results Summary

The purpose of this study was to discover any association between teacher reports of differentiation use and observed use of differentiation as well as to discover what role technology plays in differentiation. Tomlinson's (2014) knowledge of differentiation in the areas of content, process, learning environment, and product, along with Hobson's (2008) study to explore differentiation in the classroom, served as a starting point for the formulation of the research conducted in this study. In this study, methods were both quantitative and qualitative. They included a questionnaire, an observation protocol, and a focus group interview. Each of these served as data collection tools to answer the research questions posed in Chapter 1.

Hobson's (2008) findings identified the differentiation strategies most frequently used by middle school teachers in a heterogeneous classroom and revealed any certain educational and/or contextual factors that influence their frequency of use of differentiation. The data from Hobson's study revealed that most teachers reported being aware of and using differentiation strategies. The data showed that teachers were twice as likely to differentiate in the domains of content and process (curriculum and instruction) as they were in the areas of learning environment/classroom management and assessments. According to the data collected and analyzed in Hobson's study, educational and contextual factors such as years of experience, training, and staff development had no positive effect on how often a teacher differentiates instruction. In fact, frequent users of differentiation reported having less staff development and less college coursework on the topic of differentiation (Hobson, 2008). The findings of this study support the findings of both Hobson's and

Tomlinson's (2001) studies, which are discussed in more detail further in the chapter.

As mentioned in the problem statement, evidence that supports differentiation of instruction remains to be presented to the field of education. Being aware of various learning styles, interests, and proficiencies is important to student growth (Strong et al., 2001). Over time, ideas about differentiation have changed just as educational tools have changed. In the United States, technology in the classroom is increasing along with the presence of technology in the curriculum (Common Core, 2015). Furthermore, the Obama administration requested $200 million in the 2016 fiscal year for educational technology state grants meant to help ensure that leaders and teachers have the tools and skills they need to use technology effectively to improve instruction and personalize learning (Office of Educational Technology, 2015). Examining the use of technology and differentiation is important because according to Stanford et al. (2010), in using technology, teachers can engage students and differ instructional rates as well as vary levels of complexity. Stanford et al. stated that technology can help teachers differentiate more efficiently. According to the Center for Applied Research and Technology (2015), technology can help advance student performance in five significant ways: technology improves student performance when integrated with curriculum content; student performance is enhanced when technology is paired with collaborative learning; technology improves performance when the application adjusts for student ability and prior experience and provides feedback to students and teachers about student performance with said application; technology can extend curriculum content (student-created products, multimedia, video streaming, etc.); and technology improves performance when used in settings where teachers, the school community, and administration support the use of technology (Smith & Throne, 2007). For these reasons,

the researchr conducted this study to explore the presence of differentiational strategies in a K-5 setting as well as the role that technology plays in differentiation in a K-5 setting.

This study began with a questionnaire that asked teachers to rate themselves regarding their knowledge of various differentiation strategies and to rate themselves regarding their use of various differentiation strategies. The researcher then conducted field observations in 12 classrooms. These classrooms were observed four times for a period of 30 minutes per observation. The researcher used an Observation Checklist to look for various differentiation strategies and took field notes using this form as well. Last, the researcher met with the participants of the study to conduct a focus group interview session in which eight questions were asked of the participants regarding differentiation and technology. The data were analyzed and the following findings were determined.

Findings

With regard to Research Question 1, the association between teacher reports of differentiation use and observed use, the data show that there was no significant difference in teacher reports of differentiation use and observed differentiation use. To answer Research Question 1, this means that the association between reports of differentiation use and observed differentiation use is that teachers consistently reported differentiating in areas where they were also observed using differentiation strategies. This was true for all four categories of differentiation: content, process, learning environment, and product. Chi-square tests were run in each area and revealed that teachers consistently reported using differentiation strategies and implementing them. In all four areas of differentiation, chi-square tests revealed that p values were not at a level that would allow the researcher to have an alternative hypothesis. In this case, the null

hypothesis that there is no significant difference in reporting versus observation of differentiation use cannot be rejected.

In addition, both questionnaire data and observation data revealed that teachers differentiate most often in the areas of content and process. Teachers also reported feeling most knowledgeable about how to differentiate in the area of content. The data also showed that teachers reported using strategies in the area of learning environment the least and were observed using strategies in this area the least as well. Teachers also reported being least knowledgeable regarding differentiation strategies in the area of learning environment.

Regarding Research Question 2, teacher use of technology for differentiation, qualitative data show that general technology use was observed slightly less frequently than technology use for differentiated instruction. Code percentages for technology use in general were 8.8% (33 cases), and code percentages for technology used for differentiation were 9.1% (34 cases). When looking specifically at observed technology used for differentiation in each area of differentiation, the researcher found that there were 19 cases in which technology was used in the area of content, 14 cases in the area of process, four cases in the area of learning environment, and five cases in the area of product.

Data from interview questions and the open-ended question of the questionnaire were also analyzed using open-coding. These data revealed teacher reports of frequency of general use of technology, technology used for differentiation, and a lack of technology. Figure 10 shows that 44% of teachers report a lack of technology in the classroom. Many comments in the interview question session indicate that teachers feel they lack the resources needed to differentiate with technology. One teacher, for

example, said that she felt she needed more one-on-one technology so she could use the Chromebooks to differentiate. She went on the say that she only has four Chromebooks in her classroom but has 19 students and further stated that she usually uses technology whole group using her AcitivBoard. Another teacher (Teacher D) shared that she felt that she needed a refresher on how to use technology and that technology was given to her without any professional development on how to differentiate with it. Teacher D stated, "I wish the county would provide me with a refresher on how to use the Activboard, especially how to find resources that are already created like flipcharts that I can use with me students."

Furthermore, of the responses given to focus interview questions, there were only two mentions of differentiation in the areas of content and process. To the researcher, this seemed low; however, relative to the reports of differentiation in the areas of product and learning environment, it was not. These areas had no mention of differentiation in interview responses. Comment samples below (Table 12) show questions asked and responses given by two teachers in the focus group interview, Teacher A and Teacher B.

Table 12

Focus Interview Question Samples

Interview Question	Teacher A Response	Teacher B Response
1.What does differentiation mean to you?	Differentiation is based on student need.	It is teaching for all levels.
2. What strategies come to mind when you hear the term differentiated instruction?	Guided Reading Groups	Instruction on the students' level. I use an assistant to help with one-on-one instruction.
3. What instructional strategies do you use in your classroom?	Guided Reading Groups and intervention time. We don't have enough computers so we have to wait until we can go to the computer lab to do this.	I use a program called Smarty Ants on computers. Guided Reading time is a strategy.
4. How do you differentiate for students in your classroom? Give examples.	We use Guided Reading groups and sometimes small math groups.	Volunteers, one-on-one, instruction and guided reading groups
5. What resources do students in your classroom have access to?	Guided Reading books, online programs, programs given by the county	Guided reading resources, websites, Achieve 3000
6. How do students show mastery?	Progress Monitoring, Reading 3D testing	Tests
7. What role does technology play in your classroom?	We use the computer lab to go to websites. We don't have enough one-on-one technology.	We use our Chromebooks to to to PebbleGo and Discovery Education. We use the ActivBoard and we use interactive math games.
8. How do you use technology to meet the needs of students in your classroom?	I feel like I can't because I don't have enough technology. I have 19 students and only 4 Chromebooks. Other teachers get a lot more technology and more training, but not kindergarten.	I like to use online programs that the county provides. They adapt to student learning levels. I also use websites and the ActivBoard, but we mostly use our Chromebooks.

Overall, when looking at qualitative data, technology was mentioned the majority of the time to differentiate in the area of content. Field note data showed that the use of technology to differentiate in the four areas put together (content, process, learning environment, and product) was coded as overlapping a total of 43 times. In the area of content, there were 19 instances in which content differentiation and the use of technology for differentiation overlapped. In this area, there were 10 mentions of

Chromebook use and five mentions of program use for purposes of differentiation. In the area of process, there were 15 instances where differentiation occurred along with technology. The mention of Chromebook use in this area occurred five times, and the mention of programs for differentiation occurred nine times. In the area of learning environment, there were four overlapping cases of differentiated instruction and the aid of technology in differentiation, including two mentions of Chromebook use and two mentions of program use. In the area of product, there were five cases in which differentiation in this area and technology use occurred. These included one mention of the lumens (overhead projector) and four mentions of program use for differentiation.

Open-coding data from interview questions show that there were four times when differentiation with technology and differentiational strategies occurred. The areas of content included two of these occurrences, and the area of process included the remaining two. There were only two overlapping instances of technology and differentiation as revealed by questionnaire open-coding data. These took place in the area of process. Tables 9-11 show each of these qualitative areas of data collection and the results regarding the use of technology to differentiate. Tables 9-11 display data that informs the researcher that most differentiation using technology takes place within the areas of content and process. This shows up in quantitative data as well as qualitative data.

Comparing Quantitative and Qualitative Data

When looking at all of the data as a whole, quantitative and qualitative data showed similarities in findings. The questionnaire collected both quantitative and qualitative data. The quantitative data from the questionnaire show that teachers reported using differentiation strategies at a significance level that was not below .05 in any of the areas of differentiation. The qualitative data did reveal that teachers reported using and

were observed using differentiation strategies most often in the areas of content and process and were most knowledgeable of differentiation strategies in the area of content. The questionnaire revealed that teachers in this study felt the least knowledgeable about how to differentiate in the area of learning environment. Similarly, the qualitative piece of the questionnaire revealed that teachers mentioned differentiation most often in the area of process and least often in the areas of product and learning environment. Some teachers expressed a need for training and some expressed that they had already had training.

Additionally, observational data were collected in the form of quantitative and qualitative data. The Observation Checklist allowed for field notes and tallies of the presence of specific differentiation strategies in each area of differentiation. The quantitative data collected using this tool showed that teachers differentiated more in the areas of content and process than in the areas of learning environment and product. Qualitative data from this tool revealed that differentiation strategies were heavily recorded in the area of content and most often included technology themes such as "Chromebook" and "program." The mention of program usage often included phrases such as "adapts to learning level," meaning that technology was most often observed in the area of content when used for differentiation purposes.

Last, focus interview questions were asked of the 12 participating teachers. There were a total of eight questions. The questions included inquiries about how differentiation occurred in teacher classrooms and the role technology plays in the classroom. Data from this tool showed that teachers reported differentiating more in the areas of content and process and that differentiation using technology occurs in these areas most often as well. The following section provides recommendations based on

findings from these three data points.

Implications of the Study

The results of this study correlate with other theories and findings regarding differentiation use in elementary settings and differentiation used in conjunction with technology. Both Tomlinson's (2000) and Hobson's (2008) study, mentioned in Chapter 1, showed that teachers tend to differentiate in areas where they feel most comfortable. In this study, if this holds true, teachers seem to be most comfortable in the areas of content and process and least comfortable differentiating in the areas of product and learning environment. Tomlinson (2014) said that differentiation does not happen overnight and that teachers who want to meet the needs of all learners in all four areas of differentiation must establish a vision, implement strategies one step at a time, prepare for change to be a slow process, seek support from other teachers who are well practiced at differentiation, and plan staff development to meet their needs. It is important to provide students with a learning environment that is healthy and meets their needs (Tomlinson 2014). Tomlinson (2014) said that teachers who differentiate should ask what sort of things a teacher could do to create an environment in which students continually grown in respect and caring for one another and how to create an environment when subject matter is a catalyst for individual and group growth. This information, coupled with data findings, encourages the researcher to consider the importance of staff development and reflection regarding all four areas of differentiation, not just those teachers feel most comfortable using.

Regarding technology and differentiation, the researcher also believes the data from this study point to an importance in professional development regarding how to use technology as well as examining student and teacher access to technology. Teachers in

this study express a need for more technology and a need for more professional development on how to use technology to benefit students. Smith and Throne (2007) said that when differentiation and technology are integrated, the two become very powerful. Smith and Throne said that as technology increases, this "will soon be apparent to teachers who successfully use technology in a differentiated environment. Technology is a highly motivating, interactive tool that can be used to personalize students' instruction according to their learning styles, interests, and readiness" (p. 13). Furthermore, Smith and Throne stressed that in an overwhelming educational world, technology and differentiation can be an educator's biggest ally in helping teachers meet curriculum demands, manage various learner needs, and organize a classroom that is well run. Smith and Throne said that scaffolding and peer coaching are key in integrating technology use with differentiation.

The researcher believes that this study provides generalizations for educators in an elementary setting. Teachers in this study reported and used differentiation strategies more in specific areas. This is likely true for other teachers in similar elementary settings. Consistent with Hobson's (2008) and Tomlinson's (2000) findings, this study found similarities in both quantitative and qualitative data collected. Creswell (2014) said that generalizations represent interconnected thoughts or parts linked to a whole. Creswell also said that recommendations and generalizations can be derived from comparisons of findings with information gleaned from literature and/or theories. In this way, the researcher recognizes that findings from this study confirm past findings and that more research can be done in order to expand on the topic of what areas teachers differentiate in, why they differentiate in specific areas, and the role technology plays in differentiation.

Recommendations

Based on the data discussed in Chapter 4 and the findings discussed above, the researcher concludes that there is no significant difference in teacher reports of differentiation use and observed differentiation use; therefore, the association between reports and use of differentiation is that teachers consistently reported using strategies they were also observed using. The researcher also concludes that in this particular setting, teachers differentiate more often in the areas of content and process than in the areas of learning environment and product. The researcher also concludes that technology used for differentiation takes place more frequently in the areas of content and process and that teachers desire more one-on-one technology in order to better differentiate. Teachers also expressed a need for more professional development in the areas of differentiation and with regard to using technology to differentiation for students. Considering these conclusions, the researcher recommends the following.

1. This study be replicated in middle and high school grades.
2. This study be replicated in other areas of the county.
3. More training be provided to teachers on how to differentiate in the areas of product and learning environment.
4. More training be provided to teachers on how to use technology to differentiate for students, specifically in the areas of product and learning environment.
5. More research be done regarding differentiation using technology and how the amount of access to technology impacts differentiation.
6. An inventory of available technology be done in the county leading to the development of a plan to close any gaps in technology availability.

7. Further research be done comparing use of technology and access to technology according to grade level.

The researcher recommends that this study be replicated in higher grades in order to determine if teachers differentiate in the same areas as determined by this study. The researcher also believes that a replication of this study in higher grades and in other parts of the county would provide more insight into not only what areas teachers differentiate most but also how access to technology affects differentiation.

Since teachers expressed a need for more technology and more training, the researcher recommends that professional development be provided to teachers in the elementary level regarding differentiation strategies and how to use technology when differentiating. The researcher recommends that this professional development focus heavily on ways to differentiate in the areas of product and learning environment since these areas were consistently low areas in which differentiation occurred in this particular study. Due to consistency in teacher reports of differentiation use and observed differentiation use, the researcher recommends that some form of reflection of differentiation be included in grade-level planning in addition to professional development. This would allow for teachers to monitor their progress in trying new differentiation strategies in areas other than content and process which, according to Danielson (2006), extended teacher habits of mind in other areas of instruction and allowed them to ensure that difficulties are recognized and adjustments are made as work in particular areas progress. Reflection also encourages teachers to become leaders, as it makes them alert to changing conditions and they are able to see that teaching practices are subject to revision and improvement (Danielson, 2006). Tomlinson (2014) also mentioned the importance of reflection when trying new differentiation strategies in the

classroom. Tomlinson (2014) said that it is important for teachers to ask questions in order to reflect on the effectiveness of new strategy use. These questions should guide the teacher in examining student engagement, evidence that students are benefitting from new strategies, what worked and did not work during a lesson, if materials and resources were offered adequately, how to gather data, and how to improve teacher use of new strategies (Tomlinson, 2014).

Last, the researcher recommends that the county conduct an inventory of available technology in schools throughout the county. There may be possible gaps in the availability of technology from grade to grade and school to school. This assumption is based on the comments that many teachers made regarding the lack of technology in relation to their ability to use technology when differentiating for students. This recommendation is also based on the 44% report of a lack of technology reported by teachers during focus interview questions (Figure 8). Taking a closer look at technology across the district could allow the district to develop a plan to fill in any technology gaps identified.

In conclusion, this study revealed that teachers in this specific study reported and were observed differentiating instruction mostly in the areas of content and process and that there were no significant differences between teacher reports of differentiation and observed differentiation. Similar to the results of Hobson's (2008) study, this study revealed that teachers differentiate most often in the areas of content and process. Additionally, technology use for differentiation in this study occurred mostly in the areas of content and process. Further research, as suggested above, could allow for further insight into why these two areas are more prominent areas of differentiated instruction, how to increase differentiation in other areas, and uncover better ways to integrate

technology into differentiated instruction.

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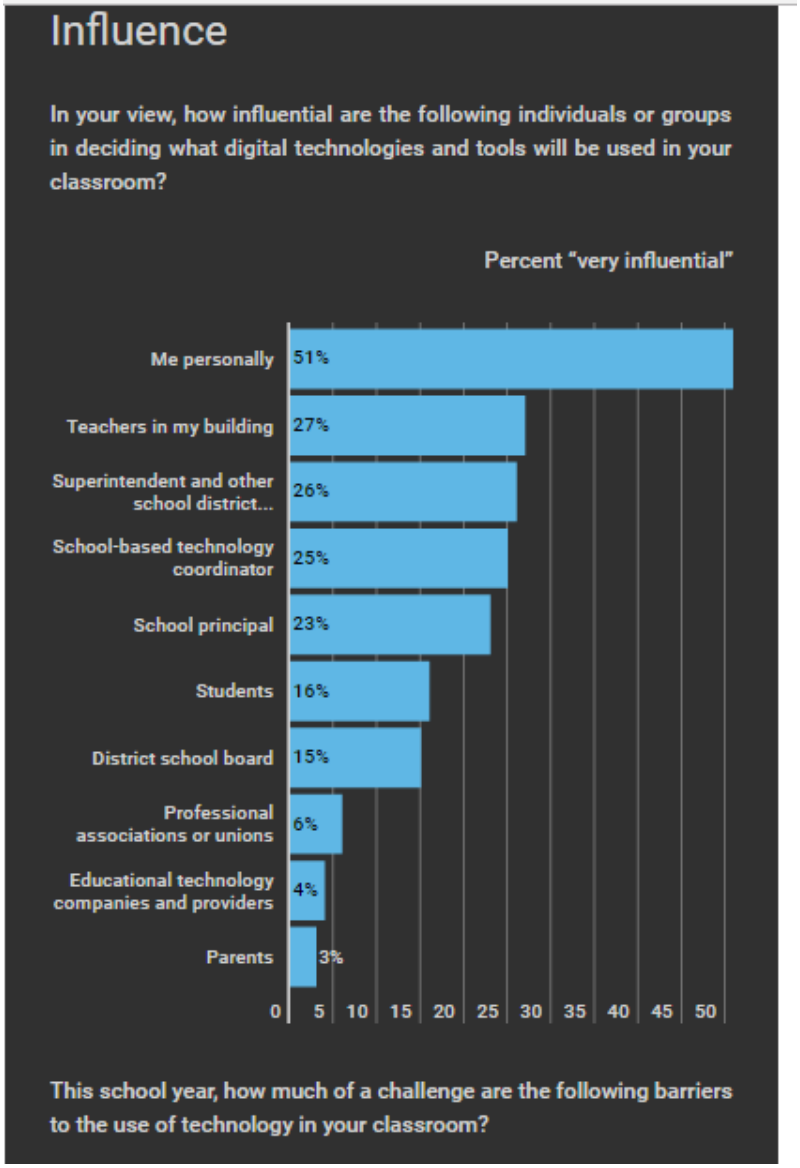
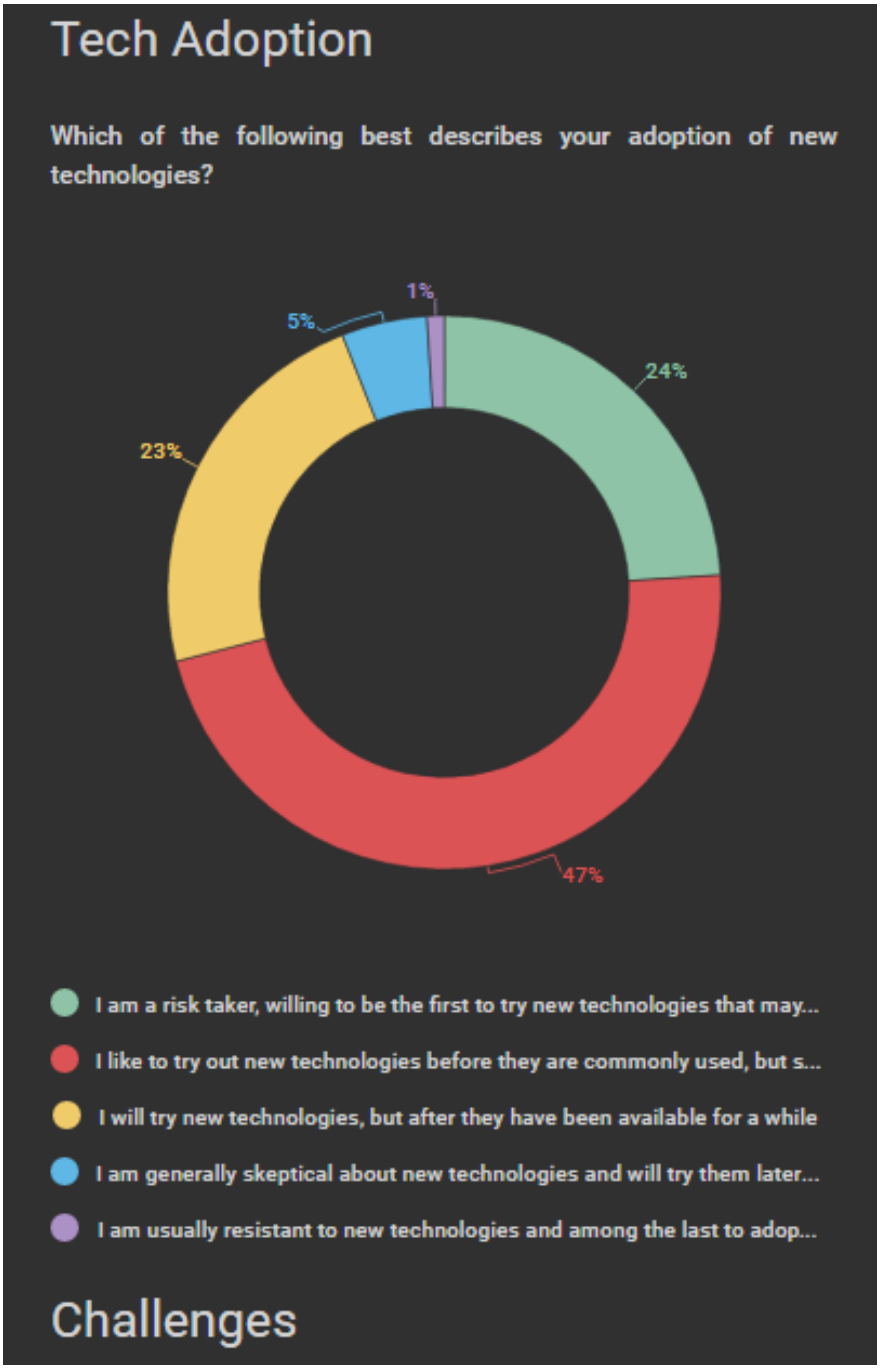
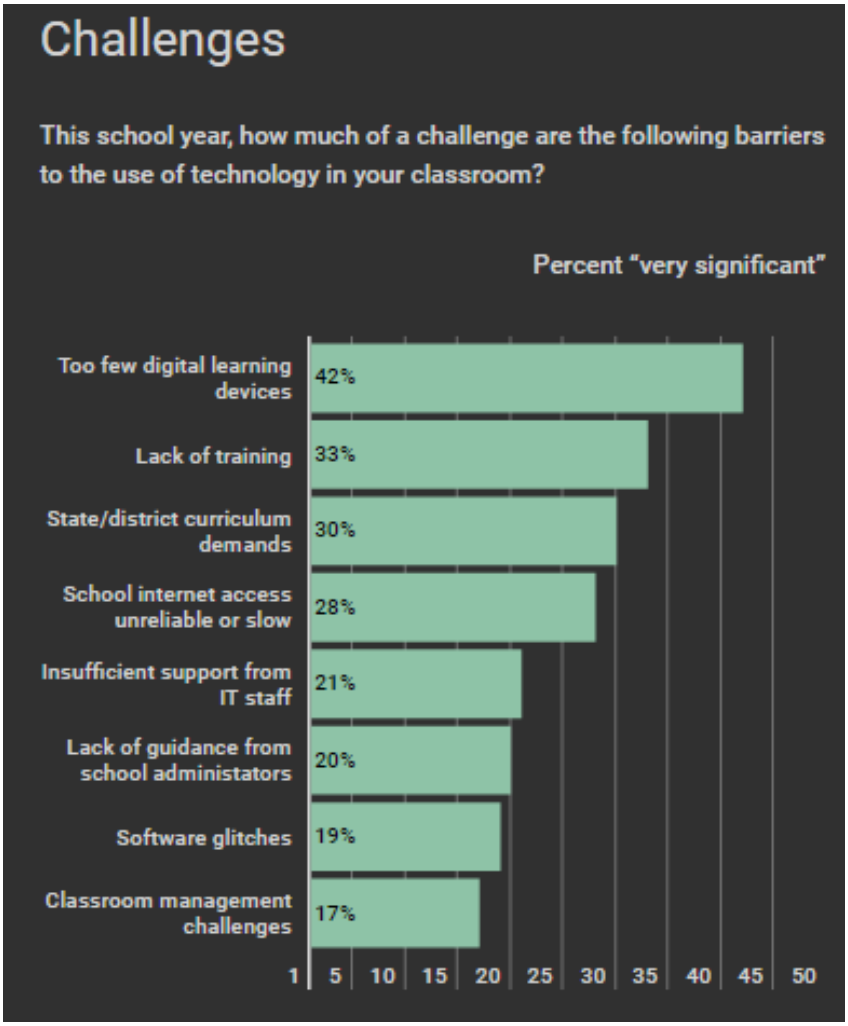
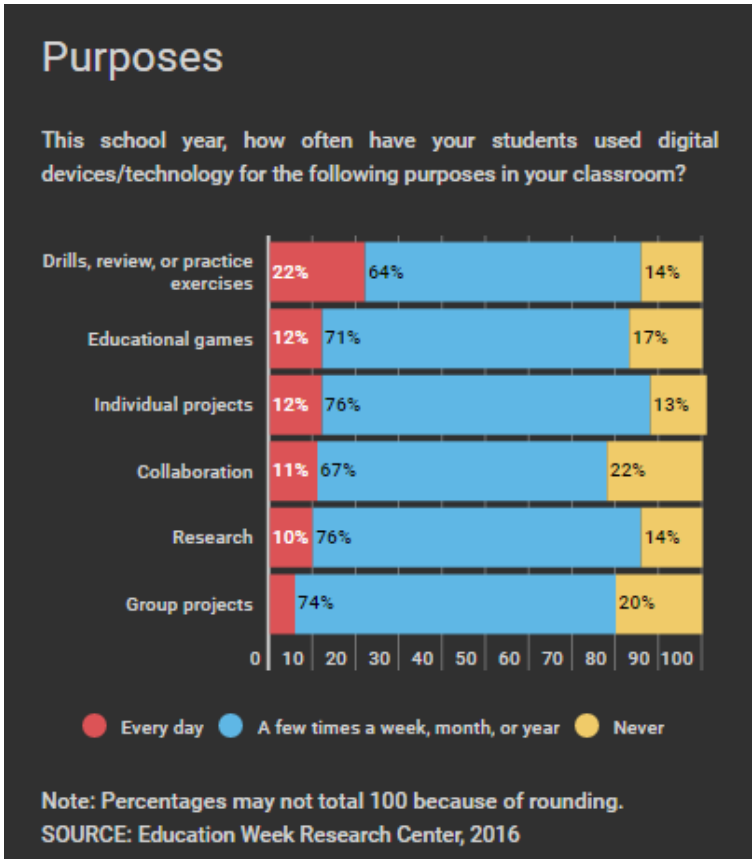
Appendix A

Technology Counts (2016) Data


Influence
In your view, how influential are the following individuals or groups in deciding what digital technologies and tools will be used in your classroom?
Percent "very influential"
Me personally
51%
Teachers in my building
27%
Superintendent and other school district...
26%
School-based technology coordinator
25%
School principal
23%
Students
16%
District school board
15%
Professional associations or unions
6%
Educational technology companies and providers
4%
Parents
3%
0
5
10
15
20
25
30
35
40
45
50
This school year, how much of a challenge are the following barriers to the use of technology in your classroom?


Tech Adoption
Which of the following best describes your adoption of new technologies?
1%
5%
24%
23%
47%
I am a risk taker, willing to be the first to try new technologies that may...
I like to try out new technologies before they are commonly used, but s...
I will try new technologies, but after they have been available for a while
I am generally skeptical about new technologies and will try them later...
I am usually resistant to new technologies and among the last to adop...
Challenges


Challenges
This school year, how much of a challenge are the following barriers to the use of technology in your classroom?
Percent "very significant"
Too few digital learning devices
42%
Lack of training
33%
State/district curriculum demands
30%
School internet access unreliable or slow
28%
Insufficient support from IT staff
21%
Lack of guidance from school administators
20%
Software glitches
19%
Classroom management challenges
17%
1
5
10
15
20
25
30
35
40
45
50


Purposes
This school year, how often have your students used digital devices/technology for the following purposes in your classroom?
Drills, review, or practice exercises
22%
64%
14%
Educational games
12%
71%
17%
Individual projects
12%
76%
13%
Collaboration
11%
67%
22%
Research
10%
76%
14%
Group projects
74%
20%
0
10
20
30
40
50
60
70
80
90
100
Every day
A few times a week, month, or year
Never
Note: Percentages may not total 100 because of rounding.
SOURCE: Education Week Research Center, 2016

Appendix B

Survey/Questionnaire and Observation Checklist

Section II

This section of the questionnaire is divided into two scales. The column on the left (the letters) reflects your assessment of your knowledge and skill regarding various aspects of differentiation. The column on the right (the numbers) deals with frequency of use in your classroom. Please circle your responses for both columns.

THE LEFT COLUMN:

(A) I don't really understand what this means and don't know how to do it.

(B) I feel somewhat comfortable doing this, but I need more information and/or practice.

(C) I understand what this means and feel comfortable/competent doing it.

(D) I thoroughly understand what this means and feel adept at doing it.

THE RIGHT COLUMN:

(1) Hardly ever

(2) Sometimes – less than half the time

(3) Frequently – more than half the time

(4) Almost always or always

GENERAL

1.	A	B	C	D	Pre-assess students to determine level of understanding (readiness).	1	2 3 4
2.	A	B	C	D	Assess student interest.	1	2 3 4
3.	A	B	C	D	Assess students' learning profile.	1	2 3 4
4.	A	B	C	D	Design respectful assignments for all learners.	1	2 3 4
5.	A	B	C	D	Use flexible grouping.	1	2 3 4
6.	A	B	C	D	Vary the pace of learning for varying learner needs.	1	2 3 4
7.	A	B	C	D	Assign Students' grades that reflect individual growth and progress.	1	2 3 4
8.	A	B	C	D	Pro-actively (deliberately) plan differentiation when designing curriculum.	1	2 3 4

CONTENT

9.	A	B	C	D	Design curriculum based on major concepts and generalizations.	1	2 3 4

10. A B C D	Use those major concepts and generalizations as basis for planning differentiated lessons/activities.	1 2 3 4
11. A B C D	Clearly articulate to the students what you want them to know, understand, and be able to do.	1 2 3 4
12. A B C D	Use a variety of materials other than the standard text.	1 2 3 4
13. A B C D	Provide varying levels of resources and materials.	1 2 3 4
14. A B C D	Provide various support mechanisms (e.g., reading buddies, organizers, study guides).	1 2 3 4

PROCESS

15. A B C D	Design each activity to be squarely focused on one (or a very few) key concepts, essential questions and/or generalizations.	1 2 3 4
16. A B C D	Design activities that require students to do something with their knowledge (apply and extend major concepts and generalizations as opposed to just repeating them back).	1 2 3 4
17. A B C D	Use higher level tasks for all learners (e.g., application, elaboration, provide evidence, synthesis, etc.).	1 2 3 4
18. A B C D	Use tiered lessons/activities of varying levels of challenge.	1 2 3 4
19. A B C D	Use activities that involve all learners in both critical and creative thinking.	1 2 3 4
20. A B C D	Vary tasks from simple to complex in each lesson.	1 2 3 4
21. A B C D	Vary tasks by student interest.	1 2 3 4
22. A B C D	Vary tasks by learner profile (learning style, mode)	1 2 3 4
23. A B C D	Adapt content (e.g., text) to all levels of student proficiency	1 2 3 4
24. A B C D	Use supplementary materials to a high degree (e.g., graphs, models, visuals)	1 2 3 4
25. A B C D	Use independent study as an option for students	1 2 3 4
26. A B C D	Consider Multiple Intelligences when planning lessons and activities	1 2 3 4
27. A B C D	Use learning contracts	1 2 3 4
28. A B C D	Use curriculum compacting	1 2 3 4

PRODUCT

29. A B C D	Allow for a wide range of product alternatives (e.g., oral, visual, kinesthetic, musical, written, spatial, creative, practical, etc.).	1 2 3 4
30. A B C D	Give product assignments that differ based on individual (or group) readiness, learning profile and/or interest.	1 2 3 4
31. A B C D	Use differentiated quality rubrics for assessment of products.	1 2 3 4
32. A B C D	Teacher supports students by using a wide range of varied resources.	1 2 3 4
33. A B C D	Give product assignments that balance structure and choice. (Student choice is maximized within teacher-generated parameters.)	1 2 3 4
34. A B C D	Provide opportunities for student product to be based upon the solving of real and relevant problems.	1 2 3 4

INSTRUCTIONAL/MANAGEMENT STRATEGIES

35. A B C D	Use curriculum compacting for advanced learners.	1 2 3 4
36. A B C D	Use student learning contracts.	1 2 3 4
37. A B C D	Use independent study.	1 2 3 4
38. A B C D	Use interest centers/groups.	1 2 3 4
39. A B C D	Use learning centers/groups.	1 2 3 4
40. A B C D	Use differentiated questions in discussions, homework and/or tests.	1 2 3 4

In the space below, please comment on your classroom use of, previous training in, current attitude about or any other information you would care to share regarding differentiation in your school.

APPENDIX B

Observation Checklist of Differentiated Strategies

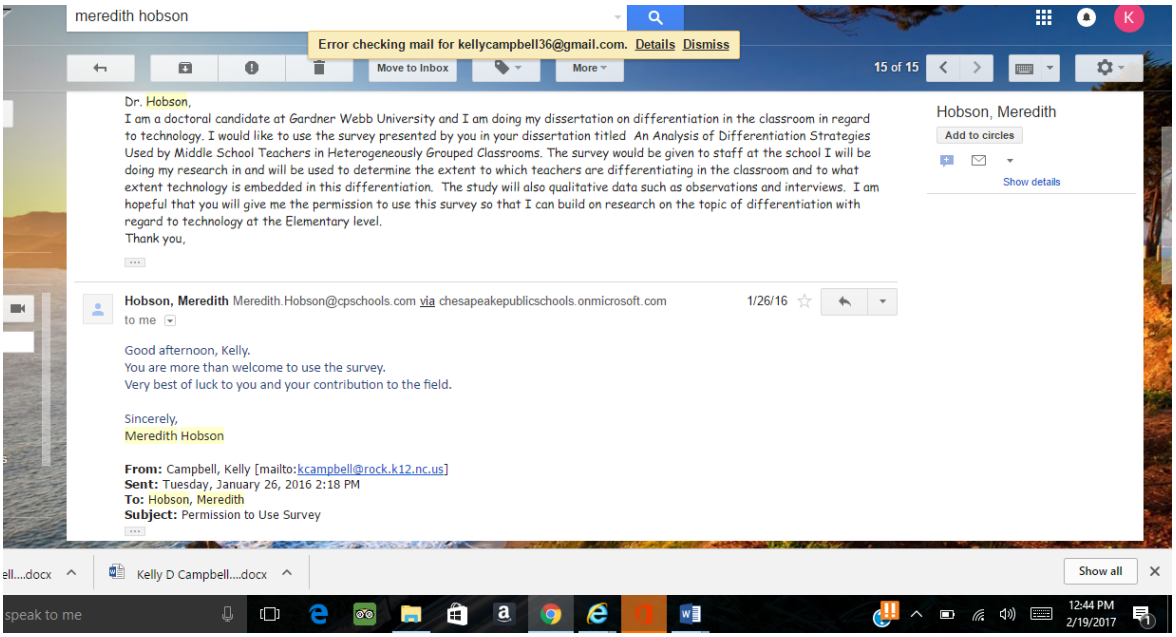
Observation Summary

Content: _____ Lesson:_____ Teacher: _____Grade Level:____

CURRICULUM (Content)	**Check if observed**
1. The teacher designs curriculum based on major concepts, themes, and generalizations and uses these major concepts and themes as a basis for planning differentiated lessons/activities.	
2. The teacher clearly articulates what he/she wants students to know, understand, and be able to do.	
3. The teacher varies curriculum and instruction from simple to complex, and from concrete to abstract.	
4. The teacher uses a variety of materials other than the standard text.	
5. The teacher provides varying levels of resources and materials.	
INSTRUCTION (Process)	
6. Teacher varies learning tasks according to student interest.	
7. Teacher varies learning tasks based on learning profile (learning style, intelligence).	
8. Teacher adapts content (e.g., text) to all levels of student proficiency.	
9. Teacher uses tiered lessons/activities of varying levels of challenge.	
10. Teacher uses curriculum compacting for advanced learners.	
11. Students work in a variety of group configurations. Flexible grouping is evident.	
12. Teacher varies the pace of learning for varying learning needs.	
LEARNING ENVIRONMENT	
13. Teacher allows for students to engage in independent study.	
14. Teacher uses interest centers/groups.	
15. Teacher uses learning centers/groups.	
STUDENT PRODUCTS	
16. The teacher gives product assignments that balance structure and choice (Student choice is maximized within teacher-generated parameters).	
17. Teacher allows for a wide range of product alternatives (e.g., oral visual, kinesthetic, musical, written, spatial, creative, practical, etc.)	
18. Teacher provides opportunities for student product to be based upon the solving of real and relevant problems.	

Appendix C

Hobson Permission


meredith hobson
Error checking mail for kellycampbell36@gmail.com. Details Dismiss
Move to Inbox
More
15 of 15
Dr. Hobson,
I am a doctoral candidate at Gardner Webb University and I am doing my dissertation on differentiation in the classroom in regard to technology. I would like to use the survey presented by you in your dissertation titled An Analysis of Differentiation Strategies Used by Middle School Teachers in Heterogeneously Grouped Classrooms. The survey would be given to staff at the school I will be doing my research in and will be used to determine the extent to which teachers are differentiating in the classroom and to what extent technology is embedded in this differentiation. The study will also qualitative data such as observations and interviews. I am hopeful that you will give me the permission to use this survey so that I can build on research on the topic of differentiation with regard to technology at the Elementary level.
Thank you,
Hobson, Meredith
Add to circles
Show details
Hobson, Meredith Meredith.Hobson@cpschools.com via chesapeakepublicschools.onmicrosoft.com
1/26/16
to me
Good afternoon, Kelly.
You are more than welcome to use the survey.
Very best of luck to you and your contribution to the field.
Sincerely,
Meredith Hobson
From: Campbell, Kelly [mailto:kcampbell@rock.k12.nc.us]
Sent: Tuesday, January 26, 2016 2:18 PM
To: Hobson, Meredith
Subject: Permission to Use Survey
Kelly D Campbell....docx
Show all
speak to me
12:44 PM
2/19/2017

Appendix D

Updated Observation Checklist

Observation Checklist of Differentiation Strategies

Observation Form

Date: **Classroom:**

CURRICULUM (CONTENT)	Check if observed	General Notes on observations and description of any technology used
1.The Teacher designs curriculum based on major concepts, themes, and generalizations and uses these major concepts and themes as a basis for planning differentiated lessons and activities.		
2. The teacher clearly articulates what he/she wants students to know, understand, and be able to do.		
3. The teacher varies curriculum and instruction from simple to complex and from concrete to abstract.		
4. The teacher uses a variety of materials other than the standard text.		
5. The teacher provides varying levels of resources and materials.		
INSTRUCTION (PROCESS)		
6. The teacher varies learning tasks according to student interest and or learning profile.		
7. The teacher adapts content to all levels of student proficiency.		
8. The teacher uses tiered lessons, compacting, or activities of varying levels of challenge.		
9. Students work in a variety of group configurations Flexible grouping is evident.		
10. Teacher varies the pace of learning for varying learning needs.		
LEARNING ENVIRONMNET		
11. Students have access to a wide range of resources and learning tools.		
12. The teacher allows for students to engage in independent study.		
13. The teacher uses interest centers/ groups.		
14. The teacher uses learning centers/groups		
STUDENT PRODUCTS		
15. The Teacher supports students by using a wide range of varied resources.		
16. The teacher gives product assignments that balance structure and choice.		
17. The teacher allows for a wide range of product alternatives.		
18. The teacher provides opportunities for student product to be based on the solving of real and relevant problems.		

Appendix E

District Approval

[redacted]

March 1st, 2017

To Whom It May Concern:

This letter serves as support for Kelly Campbell to contact the potential research participant in [redacted] School for the study title **Differentiation and Technology: A study of an Elementary School's Use of Technology in Differentiated Lessons.**

[redacted] Schools Understands that this letter of support in no way obligates the potential research participant in participating in the research. It serves as permission for Kelly Campbell to contact the potential participant and proceed with research protocol as outlined in the IRB application and pending approval from the governing Univeristy.

[redacted]

3/1/17
Date

Appendix F

Consent Form

Gardner-Webb University IRB
Informed Consent Form

Title of Study
Differentiation and Technology: A study of an Elementary School's Use of Technology in Differentiated Lessons

Researcher
Kelly Campbell/Teacher/Doctoral Candidate (Gardner-Webb University)

Purpose
The intent of this research study is to attempt to determine the differentiation strategies of which teachers are aware in an elementary school in a rural southeastern school district, as well as, determine the frequency of which differentiation occurs and the frequency of which differentiation occurs when technology is used.

Procedure
This study will involve the researcher surveying a portion of elementary school teachers across the county, as well as, conducting 3 30 minute observations at one elementary school to record occurrences of differentiation and technology use. The study will also involve the researcher meeting with a focus group to ask interview questions regarding the topic.

Time Required
It is anticipated that the study will require about 110 minutes of your time. These minutes are made up of the 3, 30 minute observations, in addition to, focus group interview time.

Voluntary Participation
Participation in this study is voluntary. You have the right to withdraw from the research study at any time without penalty. You also have the right to refuse to answer any question(s) for any reason without penalty. If you choose to withdraw, you may request that any of your data which has been collected be destroyed unless it is in a de-identified state.

Confidentiality
Data will be collected using an anonymous questionnaire, as well as, anonymous interview questions, and observations. No mention of school, district, or teacher names will be used in this study. Data will be kept confidential. All observational notes and notes taken from the focus interview session will be destroyed after the study has been completed.

Anonymous Data
The information that you give in the study will be handled confidentially. Your data will be anonymous which means that your name will not be collected or linked to the data. Because of the nature of the data, it may be possible to deduce your identity; however, there will be no attempt to do so, and your data will be reported in a way that will not identify you.

Risks
There are no anticipated risks in this study. If, as a result of the study, you experience discomfort and would like to discuss your thoughts or feelings with a counselor, please contact the following individual for assistance.
Kelly Campbell 336-407-9162

Benefits
There are no direct benefits associated with participation in this study. The study may help us to understand the role that differentiation plays in elementary schools, as well as, the role that technology plays in differentiated lessons. The Institutional Review Board at Gardner-Webb University has determined that participation in this study poses minimal risk to participants.

Payment
You will receive no payment for participating in the study.An incentive will be offered to those participating. Those that agree to participate in observations and the focus group interview will receive a Teachers Pay Teachers gift card. Those that complete the questionnaire will be entered into a drawing to receive a Teacher Pay Teacher gift card.

Right to Withdraw From the Study
You have the right to withdraw from the study at any time without penalty.

How to Withdraw From the Study
If you want to withdraw from the study, please contact Kelly Campbell at 336-407-9162. There is no penalty for withdrawing.

If you have questions about the study, contact the following individuals

Kelly Campbell
Ed.D. - Curriculum & Instruction
Gardner-Webb University
Boiling Springs, NC 28017
XXXXXXXXXXX

Jim Palermo
Curriculum & Instruction
Gardner-Webb University
Boiling Springs, NC 28017
704-406-4401
jpalermo@gardner-webb.edu

If the research design of the study necessitates that its full scope is not explained prior to participation, it will be explained to you after completion of the study. If you have concerns about your rights or how you are being treated, or if you have questions, want more information, or have suggestions, please contact the IRB Institutional Administrator listed below.

Dr. Jeffrey S. Rogers
IRB Institutional Administrator
Gardner-Webb University
Boiling Springs, NC 28017
704-406-4724
jrogers3@gardner-webb.edu

Voluntary Consent by Participant

I have read the information in this consent form and fully understand the contents of this document. I have had a chance to ask any questions concerning this study and they have been answered for me.

_____ I agree to participate in the confidential survey.
_____ I do not agree to participate in the confidential survey.

_____ I agree to participate in the focus group.
_____ I do not agree to participate in the focus group.

_____ I agree to participate in the interview session(s). I understand that this interview may be audio recorded for purposes of accuracy. The audio recording will be transcribed and destroyed.

_____ I do not agree to participate in the interview session(s).

_____ Date: _____
Participant Printed Name

_____ Date: _____
Participant Signature

You will receive a copy of this form for your records.

Appendix G

Focus Interview Questions

Focus Interview Questions

1. What does differentiation mean to you?

2. What strategies come to mind when you hear the term differentiated instruction?

3. What instructional strategies do you use in your classroom?

4. How do you differentiate for students in your classroom? Give examples.

5. What resources do students in your classroom have access to?

6. How do students show mastery?

7. What role does technology play in your classroom?

8. How do you use technology to meet the needs of students in your classroom?