

TECHNOLOGY USE FOR DIFFERENTIATION OF INSTRUCTION IN MIDDLE SCHOOL:
AN APPLIED RESEARCH STUDY

by

Cecelia Denise Baggott

Liberty University

A Dissertation Presented in Partial Fulfillment

Of the Requirements for the Degree

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ABSTRACT

The purpose of this study was to improve the use of instructional technology in differentiated learning for students at XYZ Middle School and to formulate a solution that encouraged teachers to leverage the benefits associated with using technology to differentiate. In 2016 the school adopted a one-to-one initiative that provided each student with a Chromebook to use at school and home. Since that time, state-mandated testing scores had shown improvement; however, large disparities in those results among various subgroups exposed the need for using the provided technology to differentiate instruction. This research answered the question: How can educators improve the use of instructional technology in differentiated learning for students at XYZ Middle School? XYZ Middle School served 947 students in grades six through eight and implemented a schoolwide Title 1 program. This applied study employed a multimethod approach utilizing both qualitative and quantitative data to solve the problem in practice. Qualitative data included interviews of five members of leadership and a focus group of four teachers. Quantitative data included a survey of teachers who taught core classes. Data collected was analyzed and triangulated for validity. The themes identified were used to formulate a solution to the problem in practice.

Keywords: differentiation, educational technology, differentiation with technology

Dedication

This dissertation is dedicated to Alan, AJ, Alex, and Stephen. You are the ones who inspire me every day to give my best effort and be a little better than I was the day before. Alan, thank you for your continued support through this process and keeping me grounded. Your insight and honesty were helpful on more than one occasion during this research. You are my better half. Without you, I would not be me. AJ, Alex, and Stephen, you are the best. I am so proud of the men you have become, and your lives served as my motivation throughout this process. AJ, your ability to balance life with consistent work served as my model for setting my schedule and maintaining fidelity to the plan. Alex, your relentless belief in no excuses and working every day to create the best version of yourself was the standard I used to guide my work throughout this research. Stephen, your ability to set a goal and exceed it by a mile served as my measure for what I expected of myself and helped me to meet each milestone required for success throughout this process. I could not ask for a better husband and sons. Know that I could not have done this without you guys. I am fortunate that I have each of you and love you all beyond words.

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List of Abbreviations

Association for Supervision and Curriculum Development (ASCD)

Computer-Assisted Instruction (CAI)

Economically Disadvantaged (ED)

English Language Learners (ELL)

Individuals with Disabilities Education Act (IDEA)

Individualized Education Plan (IEP)

Limited English Proficiency (LEP)

Learning Management System (LMS)

Professional Learning Community (PLC)

Students with Disabilities (SWD)

Teacher Keys Effectiveness System (TKES)

Understanding by Design (UbD)

Zone of Proximal Development (ZPD)

CHAPTER ONE: INTRODUCTION

Overview

As classrooms continue to grow in diversity so does the call for teachers to provide a curriculum in which students with mixed abilities can engage. While current research supports the use of instructional technology as an interface for meeting different students' needs simultaneously (Awada & Faour, 2018; Christensen, Horn, & Johnson, 2011; Gheradi, 2017), in many schools a gap between research and practice remains. In 2016, XYZ Middle School deployed a one-to-one program providing each student with a Chromebook to use at school and home. Since that time, end-of-year testing data did not indicate that the technology was being used to its fullest potential to differentiate instruction. This study investigated the use of instructional technology in differentiation and sought to find strategies to improve practices that benefit all students regardless of readiness level. The purpose of Chapter One is to provide a framework for the research that includes background information, a purpose statement, significance of the study, research questions, important definitions, and a summary of the chapter.

Background

Differentiation is an approach to instruction where teachers recognize students' readiness levels and then provide different paths to learning and demonstrating mastery of content (Tomlinson, 2017). Teachers who use this approach plan with an understanding that students have different learning needs and interests. Differentiated instruction includes identifying students' readiness levels based upon formative assessment data and using those results to plan lessons that match students' needs (Smets & Struyven, 2018). Differentiation is not a new topic for educators but is quickly becoming more prominent. As student diversity continues to

increase, so does the need to differentiate learning experiences (Wachira & Mburu, 2019). Preparing tiered lessons for students with multiple levels of readiness through differentiated instruction can be a daunting task. Aftab (2015) found that teachers felt they did not have enough time to plan or instructional time to implement differentiated learning. The availability of technology is changing that task and creating new possibilities for educators and students that did not exist before (Tahiri, Bennani, Idrissi, & Idrissi, 2017). Although students have always presented individual needs, an annual survey report from the Consortium for School Networking highlighted how the availability of classroom technology is growing. According to Maylahn (2018), author of the report, of the 386 districts surveyed 63% of the middle schools supplied one-to-one technology access for students in 2018 compared to the 56% reported the previous year. Students have more opportunities to use technology in learning than ever before. Fully understanding the need for using instructional technology to differentiate learning requires reviewing the evolution of such from a historical, social, and theoretical context.

Historical

While classrooms have not always been as diverse as today, the need for differentiation has long existed (Tomlinson, 2014; Turner & Solis, 2017). From the earliest days of schooling to modern times, the readiness levels of students within a single classroom have remained heterogeneous (Tomlinson, 2016). School systems organize grade levels to correspond with age, so children start school according to the month of birth and continue through the process with others in the same age group. Unfortunately, there is no guarantee that students at similar ages are of equal readiness, so teachers typically plan content for those students with average abilities. Since age is not a true measure of readiness, some students cannot engage in learning activities on grade level and others are never challenged by the curriculum of their grade level.

Differentiated learning is not new to education; students of similar age groups have never been cognitively equal due to sharing the same birth year (Sousa & Tomlinson, 2018). Schools of the past and present are an aggregate of students who arrive with different backgrounds, life experiences, and interests. According to schema theory, people conceptualize understanding of the world around them based upon experiences, store that structured information for recall, and apply constructed understanding of the past to new experiences (Liu, 2015). Variations in life experiences cause different students to have different understandings of new learning. Throughout time, the culmination of student schema and readiness levels has created a need for differentiating instruction (Tomlinson, 2014).

Historically, the implementation of differentiated instruction has been accompanied by a variety of challenges (Sousa & Tomlinson, 2018). There have been both intrinsic and extrinsic obstacles for classroom teachers that have made it difficult to consistently use a differentiated approach. Intrinsic challenges for teachers include low self-efficacy and feelings of uncertainty regarding planning appropriate lessons for a wide range of students (van Geel, Keuning, Frèrejean, & Dolmans, 2019). Self-doubt can discourage teachers from trying new strategies and limit their willingness to seek out opportunities to implement a differentiated approach. Extrinsic barriers include cultures of tradition, the structure of how schools operate, and a lack of a clear definition of differentiated instruction (Tomlinson, 2016). Leadership impacts every aspect of education for those they lead (Gurr & Drysdale, 2018), classroom teachers in particular, so extrinsic and inadvertent barriers such as a lack of professional development and time-consuming duties set forth by the administration can be difficult to overcome (Siam & Al-Natour, 2016). Internal and external factors have made implementing differentiated instruction a complex and misunderstood approach to learning. Although a few may be able to overcome such

challenges, many teachers have not been in environments conducive to using differentiated instruction and have not received clear guidance on what this approach is and is not (Ismajli & Imami-Morina, 2018).

While most teachers agree on the effectiveness of differentiated instruction, this approach to teaching has been described as difficult to implement and time-consuming (Aftab, 2015; de Graaf, Westbroek, & Janssen, 2019; Valiandes & Neophytou, 2018). Before the integration of instructional technology, teachers who differentiated instruction had the difficult task of meeting the needs of different students without an interface other than themselves. Preparing and facilitating lessons for students with mixed abilities without help was time-consuming and difficult to execute. Gheradi (2017) found that integration of one-to-one technology opened the possibility of differentiating instruction for students receiving special education services within a group of teachers who could not previously do so. While in the past differentiation may have been a cumbersome task, current technology is an interface that allows teachers to meet the needs of students with mixed ability levels simultaneously in the same classroom setting (Christensen et al., 2011; Tahiri et al., 2017).

Social

Technology has infiltrated our society and is an integral part of everyday day life for most Americans. According to the Pew Research Center (2019), 96% of Americans own a cell phone, and of those, 81% own smartphones. Many people manage their time, keep a calendar, and handle finances from their phones. In addition to cell phones, families own other devices such as tablets, desktops, and laptop computers. Recent developments in communication and computer technology have made it possible for schools to implement extensive use of internet resources in student learning (Yenmez, Ozpinar, & Gokce, 2017). All stakeholders, including

parents, support student use of technology for instruction (Ozdamli & Yildiz, 2017). Likewise, some teachers believe that using technology in class is paramount to student success in the world after graduation (DiCicco, Cook, & Faulkner, 2016). Extensive use in daily living has transferred into school systems as an expectation that technology should be an integrated part of the learning experience.

Current societal expectations and beliefs center on the need for integration of technology that supports classroom instruction and the prevalent use of technology has created a ubiquitous expectation that student learning includes integrated experiences (Snape, 2017). Along with grading, communicating, and testing, there is a presumption that integration of technology includes instruction as a means of preparing students with modern learning experiences (Obi, Obiakor, & Graves, 2016). Moving into a time when technology is exponentially increasing the availability of knowledge, it is expected that students will learn how to access information and use it to solve 21st-century problems (Horak & Galluzzo, 2017). The recent outbreak of Covid-19 has emphasized the need for using technology to deliver learning, support instruction, and assess knowledge. Due to the outbreak of Covid-19, 191 countries closed schools, which impacted 1.6 billion students as of mid-April 2020 (Bryant, Li-Kai, Dorn, & Hall, 2020). The expectation that schools utilize technology for instruction has never been greater than now during this current pandemic.

Students also expect that technology will be used in school. Outside the classroom, students use technology as a part of their daily lives and expect that use to continue as part of their education (Hoffman & Ramirez, 2018). Given that students in K-12 education are digital natives, they are more comfortable using technology in learning than students of past generations. According to Hoffman and Ramirez, technology has transformed student-centered

learning by increasing student motivation, improving academic performance, and providing interactive opportunities that support differentiated instruction. The use of technology to differentiate so that all students can access curriculum at their level of readiness is a reasonable expectation that is reflected in the attitudes and beliefs of educators, students, and society.

Theoretical

Differentiation is a student-centered approach to learning that is based upon student readiness level rooted in data (Tomlinson, 2017). Planning lessons is done after a review of pretests, and learning opportunities are planned according to retrieved data. Thus, students can move at a comfortable pace and engage in academic learning at their readiness levels. Using instructional technology to implement this structure leads to students having more control in their learning. Differentiation with instructional technology gives students an opportunity to self-direct and teachers the ability to facilitate student learning (Winter, 2018).

The framework for differentiation can be found in the zone of proximal development (ZPD). The ZPD can be defined as a student's latent abilities that are not fully developed but are in the process of developing (Vygotsky, 1978). A student who is working in the ZPD will be able to complete a task with assistance. Differentiated instruction includes meeting students at their readiness levels and scaffolding until they can complete a task on their own. Students work at a level that is just out of reach without assistance until the skill is mastered and the scaffold is no longer needed. Soon after, readiness levels increase, and the next lesson is based upon the new level. Learning takes place when students can actively engage in tasks that are related to their personal experiences (Sousa & Tomlinson, 2018). Students engaged in differentiated learning using instructional technology can acquire an understanding of the curriculum along with others who are also having their specific needs met; thus, opening opportunities for all students to

experience effective instruction that results in learning.

Differentiation using instructional technology allows teachers to work with students using methods that appeal to their interests and needs and provides students the opportunity to self-regulate their learning. Instructional technology creates a student-centered learning environment that supports differentiated instruction and promotes learning that goes beyond traditional methods (Jaleel & Anuroofa, 2017). Both the zone of proximal development and self-regulation are characteristic of a constructivist approach to learning, which is linked to an increase in academic achievement and student motivation (Farisi, 2016; Horak & Galluzzo, 2017; Yenmez et al., 2017). Using technology to differentiate learning is grounded in a constructivist approach that emphasizes providing instruction in the ZPD for all students regardless of readiness.

Problem Statement

The problem was the insufficient use of one-to-one instructional technology to differentiate learning so that all students could receive grade-level assignments that matched their abilities in a middle school. This is a common problem in the United States as students often receive information prepared without an opportunity for any input and given in whole group fashion (Hoffmann & Ramirez, 2018). However, to effectively provide students with choices in their learning, levels of readiness and learning preferences should be considered. Differentiation using instructional technology can provide all students with learning experiences that match their level of readiness in a classroom setting of students with mixed abilities. Educators can differentiate the content taught, the process of which learning takes place, the product students create, or the environment in which students learn (Winter, 2018). The problem faced by XYZ Middle School is found throughout K-12 education as there is not a clear understanding of what constitutes differentiated learning (Bondie, Dahnke, & Zusho, 2019), and

there is a lack of studies on schools that are successfully implementing one-to-one technology (Parrish & Sadera, 2020). Without sufficient models, using instructional technology to differentiate learning continues to challenge educators.

Since 2016, XYZ Middle School, a schoolwide Title1 school in a suburban area serving over 900 students in grades six through eight, has provided each student with a Chromebook to use at school and home. Analysis of the demographics revealed that while the number of students had remained stable, student diversity was increasing. Available data indicated that the number of Hispanic, Black, Asian, economically disadvantaged, and students with disabilities had increased every year since 2016 as the number of students who identified as White had decreased. Data from the 2018-2019 state-mandated testing indicated that only 51.2 % of the students at XYZ Middle School are proficient in math and 50.8% in English; however, since the roll-out of one-to-one technology, there had been improvements in learning as evidenced by state-mandated testing as indicated in Table 1.

Table 1

Proficiency Comparison

	School 2016	School 2019	County 2019	State 2019
Math	42.2%	51.2%	52.1%	39.4%
English	39.3%	50.8%	54.9%	44%
Science	44.3%	52.4%	46.3%	32.3%
Social Studies	44.5%	52.5%	48.1%	40.6%

While proficiency had increased since one-to-one learning was implemented, further analysis of the data exposed demographic disparities in proficiency in both math and English as represented in Table 2.

Table 2

Demographics of Student Proficiency in End of Grade Testing May 2019

Race/Ethnicity	Math	English
Asian	75.0%	75.0%
White	66.4%	50.7%
Two or more	55.6%	40.0%
Hispanic	44.0%	38.5%
Black	33.1%	35.2%

Likewise, there were large gaps for students with disabilities (SWD), limited English proficient (LEP), and economically disadvantaged (ED) as evidenced in Table 3.

Table 3

Proficiency of Subgroups in End of Grade Testing May 2019

Group	Math	English
SWD	14.3%	13.2%
No Disabilities	55.6%	42.6%
LEP	32.5%	17.5%
Not LEP	52.3%	52.0%
ED	33.8%	35.0%
Not ED	66.3%	64.1%

While additional technology increases the opportunity for needed differentiation, the full potential benefits of instructional technology had not yet been reaped as many teachers continued to opt for a traditional whole group approach. “Using instructional technology to accommodate learning needs based on readiness levels is the answer to the problem” (Thiele, Mai, & Post, 2014, p. 89). Using instructional technology for differentiated learning to the fullest potential can reach students of all ability levels and result in academic growth. Academic gains associated with the use of technology are reflected in the three-year comparison of test scores of XYZ Middle School; however, it must be acknowledged that almost half of the students were not

proficient in the basic standards of learning and large disparities between subgroups existed. While instructional technology can make instruction more engaging and efficient, using it for differentiation could provide an even larger boost and help specific subgroups such as LEP and SWD (Gherardi, 2017; Qahmash, 2018). This applied research study with a multi-method design sought to identify strategies that improve the problem of not using technology to its potential for differentiated learning.

Purpose Statement

The purpose of this study was to improve the use of instructional technology in differentiated learning for students at XYZ Middle School and to formulate a solution that encouraged teachers to leverage the benefits associated with using instructional technology to differentiate. A multimethod design was used that consisted of both qualitative and quantitative approaches. The first approach included structured interviews with five members of school leadership. The second approach was a survey sent to 36 core teachers who were full-time employees at XYZ Middle School. The third approach employed the use of a focus group that consisted of experienced core teachers from XYZ Middle School who taught there for at least three years.

Significance of the Study

This study is significant because it will lead to academic growth for students of all readiness levels through better use of instructional technology for differentiated learning and provide a model in an area that is lacking in current literature. XYZ Middle School was a Title 1 school that served a student population that included 47% who were defined as economically disadvantaged and a growing number of students who identified as English language learners (ELL) or as having disabilities. The school had a gifted and talented program and provided

inclusion for students with autistic tendencies. Differentiation is not a strategy for one group of students, but one that meets all students at their level of readiness and propels them to the next, so all students may benefit from this study (Smets & Struyven, 2018). Academic growth of students can be measured through pre-testing and post-testing data (Awanda & Faour, 2018) and retention of information learned through delayed testing (Yenmez et al., 2017; Yildirim & Sensoy, 2018).

Current literature has a focus on achievement and attitudes; however, there is no model to address the methods of using one-to-one technology that establish desired outcomes (Parrish & Sadara, 2020). Not only does this study provide a model for how to improve the use of one-to-one technology to deliver differentiated learning, but it includes suggestions for how to encourage teachers to implement those improvements. Improving the use of instructional technology in differentiating lessons will support learning for all students and provide a model of a strategic plan for improving the use of one-to-one technology, thereby filling a gap in the current literature.

Research Questions

Central Question: How can educators improve the use of instructional technology in differentiated learning for students at XYZ Middle School?

Sub-question 1: How can school leadership in an interview improve the use of instructional technology in differentiated learning for students at XYZ Middle School?

Sub-question 2: How can teachers in a survey improve the use of instructional technology in differentiated learning for students at XYZ Middle School?

Sub-question 3: How can teachers in a focus group improve the use of instructional technology in differentiated learning for students at XYZ Middle School?

Definitions

1. *Differentiation* – Differentiated learning is learning that is prepared for students based upon their current interest, readiness level, or learning profile. Lessons can be differentiated on the content, product, process, or environment (Tomlinson, 2017).
2. *One-to-one* – In a one-to-one learning environment, the teacher and each student has access to a device that can be used for learning (Varie et al., 2017).
3. *Student readiness* – A student’s readiness is his/her current level of understanding and skills regarding a topic (Tomlinson, 2017).
4. *Instructional technology* – An instrument that allows students to interact with the curriculum for learning (Christian et al., 2011; Liu, Ritzhaupt, & Barron, 2017; Sota, Clarke, & Nelson, 2014).
5. *Interface* – A mechanism that allows interaction in a product, organization, or group of people (Cohen, Manion, & Morrison, 2018).

Summary

The problem was the insufficient use of one-to-one instructional technology to differentiate learning so that all students received grade-level assignments that matched their abilities. The purpose of this study was to improve the use of instructional technology in differentiated learning for students at XYZ Middle School and to formulate a solution that encourages teachers to leverage the benefits associated with using instructional technology to differentiate. Historically, differentiation has been a difficult task for teachers; however, the versatility that accompanies instructional technology has made differentiation more accessible through its ability to create student-centered classrooms, freeing teachers to become facilitators of the learning process (Shaffer, 2015; Winter, 2018). Society uses technology in all aspects of

life, and the general expectation is that students have a learning environment that includes the tools that will impact their lives after graduation. This study is significant because the findings provided information that was used to identify strategies that improve the use of instructional technology in differentiation, improve student achievement, and provide a model for other schools with mixed ability classrooms to do the same. Interviews, a survey, and a focus group provided information that translated into an action plan to solve the problem of not using instructional technology to its fullest potential to differentiate instruction.

CHAPTER TWO: LITERATURE REVIEW

Overview

While students are grouped in grade levels by age, all students do not develop at the same pace. From the start of kindergarten, children have varying ability levels that place them on a broad spectrum of readiness. For many students, starting school with readiness levels behind those of their peers can result in a disparity that continues throughout their education (Diamond, Furlong, & Quirk, 2016). To close the gap in learning, students who trail peers may receive an intervention class in reading or math that raises their ability level and puts them on track with others of the same age (Haines, Husk, Baca, Wilcox, & Morrison, 2018). Unfortunately, all students who need additional services are not able to receive them, so they continue to lack the academic abilities to engage in learning using a grade-level curriculum. Classrooms today represent large amounts of diversity, and that diversity continues to increase. The National Center for Educational Statistics (2019) reported that since 2014, less than half of the students attending public school have been White, and it is estimated that the number of White students will continue to decrease through 2028. According to de Brey et al. (2019) achievement gaps measured in the fourth grade between White and Asian students and their Black and Hispanic peers were not diminished by the end of middle school. Likewise, Hispanic and Black students drop out of school at higher rates than their White and Asian peers (McFarland et al., 2019). As diversity continues to increase, so does the need to reach subgroups that can be easily overlooked when planning for heterogeneously mixed classrooms (Wachira & Mburu, 2019).

In addition to readiness, students differ in background, culture, language, and interest (Tomlinson, 2014). Students bring different talents and abilities to class, creating a mix of unique needs that must be met. To adequately respond to diverse needs, teachers must use a

differentiated approach to curriculum that meets students' readiness levels and appeals to students' interests. Bal (2016) found that utilizing student readiness levels and learning preferences to implement a differentiated approach to math positively impacted student achievement as measured by data collection from the Algebraic Success Test. Differentiated instruction is based upon data collected through assessing students to identify levels of readiness and using that data to modify lessons in content, process, product, and learning environment (Tomlinson, 2017). Differentiated learning allows students to engage in learning at their readiness levels, learn the material, and experience cognitive growth that otherwise would not occur without the provisions for differentiated learning.

Differentiation is an approach to teaching where teachers plan learning opportunities for students based upon data retrieved from a variety of sources (Sousa & Tomlinson, 2018). Data can be retrieved through formative assessment, standardized test results, an interest inventory, or a combination of resources. When differentiating instruction, teachers prepare opportunities for learning that are suited for student readiness, interests, and learning profile (Tomlinson, 2014). To adequately differentiate, teachers meet readiness levels on a large spectrum: this does not mean that teachers create individualized lessons for each student in the room (Smets & Struyven, 2018). However, approaching the curriculum in this manner does require changes to traditional practices and a clear understanding of the students being served (Bondie et al., 2019). Lessons become student-centered, and teachers become facilitators of learning rather than givers of information (Eteokleous, Ktoridoou, & Orphanou, 2014; Winter, 2018). An example of differentiated instruction is flexibly grouping students for a lesson based upon data retrieved from a pretest, while a non-example is simply pairing a weaker student with a stronger student for peer tutoring (Tomlinson, 2017).

Lack of time is an often-cited barrier for implementing differentiated instruction (Aftab, 2015). Before the widespread use of instructional technology in education, preparing and executing differentiated lessons for diverse classes could be overwhelming and time-consuming (Nagro, Fraser, & Hooks, 2019; Rehmat & Bailey, 2014; Tekedere & Goke, 2016). Simultaneously meeting the needs of different students for a single teacher without assistance is a daunting task. To adequately integrate differentiated learning, teachers could benefit from an interface that allows students to have different experiences that end with the same results. While an interface is usually thought of as a means of communication between people, it can also exist within a product (Cohen et al., 2018). Technology is an interface that provides instruction to a diverse population at different levels of readiness (Christensen et al., 2011). Instructional technology provides a platform to differentiate learning so that all students can engage in the curriculum regardless of ability level (Sota et al., 2014). Technology-supported resources create an environment where teachers can meet students' needs, appeal to their interests, and support differentiation in larger classroom settings of students with mixed ability levels (Jaleel & Anuroofa, 2018; Winter, 2018). Using literature, the following chapter will provide a context for using technology to differentiate learning through discussing the theoretical framework, reviewing the current literature, and summarizing current trends in differentiated learning supported by technology.

Theoretical Framework

Differentiation is an approach to teaching that is aligned to diversity in student readiness and preference in heterogeneous/mixed-ability classrooms. The goal of using differentiated instruction is to expand student learning to its potential (Sousa & Tomlinson, 2018). To maximize learning for all students, differentiated lessons are planned and executed in a way that

appeals to different learning styles, interests, and readiness levels. While differentiation can be difficult for one teacher to implement in large settings, current technology provides an interface for differentiated lessons (Christensen et al., 2011). Instructional technology allows teachers to post assignments, intervention material, and extensions for students to work on with little teacher assistance. Teachers become facilitators of learning and are available to help students on an individual basis as needed throughout the learning process (Shaffer, 2015; Winter, 2018). Unlike traditional methods that render students' as simply receivers of information, differentiation using technology gives students some control and accountability for their learning. When implementing differentiated strategies using technology, learning can be both student-centered and student-directed (Jaleel & Anuroofa, 2018).

Constructivism is a student-centered approach to learning where students are immersed in varying activities, preferably authentic, and supported by the teacher as they create meaning of new information (Sharkins, Newton, Causey, & Ernest, 2017). In traditional classroom settings, teachers lead the class in a whole group fashion through lessons without much interaction between students and the information presented. Students become recipients of information and are considered successful when recounting that same information back to the teacher on a test. In this classroom, students are not necessarily challenged to apply knowledge to solve real-world problems and are not encouraged to construct questions that lead to deeper understanding. Traditional methods are the antithesis of those used by a constructivist, and reforms in education call for a student-centered approach replacing the traditional teacher-centered approach (Toraman & Demir, 2016). Teachers who plan according to a constructivist approach to learning give students time to work at a comfortable pace, accept multiple answers to the same question,

and expect students to explain the thinking behind their answers (Sharkins et al., 2017). Students work on tasks to build knowledge of the topic presented.

The student-centered and student-directed nature of using technology for differentiated lessons is indicative of using constructivism as an approach to learning (Farisi, 2016; Harper & Milman, 2016). Vygotsky (1978) described how experience is central to learning. Utilizing technology to deliver instruction that is differentiated engages students and can provide experiences that are necessary for learning. In a constructivist setting, the process of reaching an answer is part of the learning experience. Wachira and Mburu (2019) described constructivism as a belief that individuals make meaning and create an understanding of concepts through activities. Constructivism is built upon the notion that students actively engage in content and create their understanding based on those experiences. In this environment, students are encouraged to find answers to questions that arise as they engage in the learning process (Sharkins et al., 2017). Using instructional technology as a means of delivering differentiated lessons provides fertile ground for a constructivist view of learning because students actively engage to synthesize knowledge through experiences, work at a comfortable pace, and explain their learning in many different forms.

Differentiation is supported by a framework of the constructivist learning theory and is specifically grounded in the work of Vygotsky's zone of proximal development (Miller-Foster, Foster, Thoron, & Barrick, 2015). When speaking of the ZPD, Vygotsky (1978) said, "It is the distance between the actual developmental level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance or in collaboration with more capable peers" (p. 86). Since the original definition of the ZPD, technological advances have infiltrated and changed the ways students can learn and

practice new information. An application of how instructional technology can serve in the framework set forth by Vygotsky is the use of computer-assisted instruction in differentiated learning. When using computer-assisted instruction (CAI) to deliver differentiated learning, teachers can provide students with needed scaffolds without an adult or peer intervening (McKissick, Diegelmann, & Parker, 2017). CAI has the capability of providing feedback and scaffolds to students so that they can work in their ZPD without teacher intervention. Students who are working in their ZPD are encountering and learning new information right above what is possible to be done without assistance; therefore, this theory is based upon the premise that planning for learning is done through the lens of anticipated cognitive development (Guseva & Solomonovich, 2017). Teachers employing differentiated practices anticipate cognitive development through data collection and analysis from formative assessments, pretests, and standardized testing. Teachers who differentiate can provide learning opportunities that cater to specific student's needs, thus allowing students to receive instruction at an appropriate level to ensure each one is working within their ZPD, maximizing learning for students of all ability levels.

A central part of constructivism and the ZPD is the aspect of communication that takes place during activities. Those who subscribe to the constructivist learning theory say that communication, scaffolding, and support received when working with another peer or adult result in moving to a higher level of development (Sharkins et al., 2017). According to Eun (2019), the most tangible definition of social interaction assumes the interaction is between two people, and those interactions happen within the environment created as a result of the institution and its history. While instructional technology was not a part of the communication initially spoken of in the ZPD, it is now a part of social interactions that are integrated into institutional

dimensions. Technology is ubiquitous in education and integrated into all parts of how educational institutions function, including communication. Using instructional technology to differentiate learning is supported through the versatility that technology offers as students communicate with people and software. Students use technology in their lives outside of school for social interaction and expect to continue that communication while at school (Hoffmann & Ramirez, 2018). Instructional technology supports learning in the ZPD through communication that occurs between students and teachers, software, and other students as students actively engage in differentiated instruction.

Differentiated learning via using technology is firmly grounded in the constructivist learning theory and provides students of all readiness levels opportunities to engage in robust learning experiences. Tomlinson (2017) explained that differentiation provides several pathways to learning curriculum for students of all readiness levels. Differentiation delivered through instructional technology is a practice that allows all students in the class to make academic gains while engaging a diverse group of students with mixed abilities simultaneously at their readiness levels (Awada & Faour, 2018; Horak & Galluzzo, 2017; McKissick et al., 2017). Active engagement promotes student growth as new knowledge is integrated into previously learned information and students work in their ZPD.

Related Literature

For many schools, instructional technology is readily available through the implementation of technology plans that provide each student with a device. Emerging technology is quickly advancing the ability of school systems to impact how students can access information and how teachers can provide learning opportunities for their classes (Tekedere & Goke, 2016). The general expectation is that teachers will use technology in the learning

environment for purposes other than grade books and taking roll. The widespread use of technology in the duties of educators has led some researchers to only include in studies that which is used for instruction and not that which is used for other administrative duties (Liu et al., 2017). Using technology for instruction opens possibilities in differentiation that did not exist in the past, and each student having his or her own device creates new opportunities for student-centered learning (Holen, Hung, & Gourneau, 2017; Thiele et al., 2014). In the past, teacher planning and employing differentiated learning for students with mixed-ability levels was a cumbersome task, but now the assistance of instructional technology offers unlimited potential presented with one-to-one learning (Gherardi, 2017).

Instructional technology is having a positive impact on classrooms and changing traditional teacher-led instruction to student-centered and student-directed learning. Every student having his or her own device has created greater flexibility in learning potential than ever before. Students in a one-to-one classroom work more efficiently, have better organization in their learning, and communicate with their teacher and peers more extensively than before each student had access to a personal device (Higgins & BuShell, 2018). A meta-analysis of 10 studies links significant academic gains in reading, writing, math, and science to one-to-one learning environments (Zheng, Warschauer, Lin, & Chang, 2016). When reviewing current literature regarding differentiation and technology, major themes emerge. These themes include defining parameters necessary for differentiated learning, student achievement, and student motivation, as well as challenges, professional development, and possible pitfalls.

Parameters of Differentiated Learning

Differentiation is not a theory of how students learn but an approach to learning where teachers consider student readiness based upon student-specific data to plan lessons that bring all

students to the same destination by providing different pathways. Differentiated instruction is implemented through deliberate planning that meets students' needs and appeals to their interests (Ismajli & Imami-Morina, 2018; Mahoney & Hall, 2017; van Geel et al., 2019). A well-defined plan for the differentiated classroom will include components that ensure all students can access the curriculum and succeed. Sousa and Tomlinson (2018) identified the five major parts of differentiated learning as "... (1) an invitational environment, (2) rich curriculum, (3) assessment to inform teaching and learning, (4) responsive instruction, and (5) leading students and managing routines..." (p. 10). Each of these components depends upon the other and is required for successful differentiated instruction. The omission of one or more results in an ineffective plan to meet the needs of all learners.

Creating an effective environment. Teachers who are differentiating create environments that reflect the love and appreciation of diversity. The primary goal of differentiating instruction is to ensure that each student reaches his or her potential growth (Bogen, Schlendorf, Nicolino, & Morote, 2019), and to do so effectively, the learning environment must be inviting to students with different learning modalities and preferences. Planning and execution of lessons should establish the importance of different learning modalities and include a variety of approaches that appeal to different students (Mahoney & Hall, 2017). Students have different learning preferences that are incorporated into the differentiated classroom. Visual, auditory, tactile, and kinesthetic learning must be available not only during the acquisition of content but should also be considered when differentiating the process and product (Malacapay, 2019). Differentiating the process and product can be as simple as giving students choices about how they learn or opportunities to demonstrate learning that has occurred. Teachers can offer students a choice board, a list of ideas, or allow students to use their

own ideas that meet all learning requirements. Appreciating and celebrating all learning styles is evident in the diverse activities and choices brought to the differentiated classroom through careful planning by the teacher. Students feel welcomed into a learning environment that caters to individual learning styles and readiness levels.

The use of instructional technology supports different modalities of learning and complements creating an environment that best fits diverse learning profiles by providing flexible classroom settings suited for all students in the room. Instructional technology provides an opportunity to offer accommodations to students with disabilities or extensions for students who have demonstrated proficiency (Mahoney & Hall, 2017). The audio-visual capacity of computer technology easily appeals to auditory and visual learners, so students can watch content and create content related to the curriculum. To be more inclusive, teachers can add learning opportunities with a hands-on component for students who need tactile experiences to fully comprehend the curriculum (Malacapay, 2019). Tactile learning experiences can be successfully integrated through the use of digital manipulatives (Bouck, Working, & Bone, 2018). Also, wearable technology is opening possibilities for kinesthetic students who learn the best while on the move. Wearable technology allows the person wearing the device to collect and transfer data to others or the cloud (Borthwick, Anderson, Finsness, & Foulger, 2015). Integrating technology into the differentiated classroom supports multiple approaches to the curriculum that appeals to a variety of learning modalities simultaneously (Taljaard, 2016).

Providing a relevant curriculum. The differentiated classroom will present a curriculum that reflects the belief that all students can succeed (Sousa & Tomlinson, 2018). Mastery of a standards-based curriculum is used to guide where all students should arrive, and differentiation provides multiple avenues to arrive at the destination. Differentiated learning

supports a constructivist approach by allowing teachers to create learning experiences through student-generated questions and interests. Teachers who plan rich experiences that lead to mastery for different students have prerequisite knowledge of both their students and the subject matter (van Geel et al., 2019). A teacher's deep understanding of content will aid in the process of identifying problematic areas for students and planning strategies to rectify those misconceptions. Effective planning is based on teacher knowledge of students in the class (Tomlinson & Imbeau, 2010). When planning diverse activities that meet students' interests, teachers must know the students for whom they are planning. Standards-based learning with planning centered on student interests and opportunities to enrich all students leads to significant academic growth (Altintas & Ozdemir, 2015).

Planning engagement for all students can be overwhelming and may seem unattainable due to the amount of diversity teachers face in classrooms (Nagro et al., 2019). Instructional technology provides an interface that supports a relevant curriculum with rich educational experiences while appealing to the learning preferences of different students. Teachers who use technology create lessons with multiple pathways through a variety of online resources, apps, and programs (Liu et al., 2017). Available resources allow teachers to give students virtual opportunities that could not otherwise be experienced. Students can remediate in subject matter, work cooperatively, engage in authentic experiences, and meet with professionals regarding the subject matter in prearranged conferences. Students at all ability levels and learning modalities can be accommodated and engaged in learning using technology as the connection between the content and students' needs by making the curriculum relevant to students' readiness levels and learning preferences (Ozerbas & Erdogan, 2016). Instructional technology supports a relevant curriculum for all students regardless of their readiness level or learning modality.

Assessment for learning. Teachers who implement differentiated learning strategies embark on a cycle of pretesting, analyzing data, creating tiered learning experiences, and post-testing to ensure students have achieved required learning targets (Smets & Struyven, 2018). To begin the process, teachers assess student readiness through formative assessment. Formative assessment is a way to identify deficits and gaps in learning before starting new units of learning or during units of learning (Bhagat & Spector, 2017). Data from the assessment is used to plan future learning for students according to the identified strengths and challenges (Shirley & Irving, 2015). Through assessments that guide planning, teachers continuously learn from their students the best way to approach curriculum and appeal to interests (Dack & Tomlinson, 2015). Students who are engaged in differentiated learning experiences receive instruction with the same learning goals but may get there through a different process, using different content, creating a different product, or by engaging in a different environment such as one that can be provided by a digital platform. Using students' readiness levels and learning profiles, teachers make lessons that appeal to varying interests and cognitive needs through differentiation. Differentiated learning stems from strategically placed assessments that guide the planning and execution of information that is accessible to students at different levels of readiness.

Assessing student knowledge is a seamless fit into the differentiated classroom using instructional technology. Instructional technology is a tool that can provide effective feedback that leads to student achievement (Bhagat & Spector, 2017; Shirley & Irving, 2015). When using technology to assess students, teachers instantly receive data on readiness levels without spending long segments of time on grading. An assessment can quickly be administered via computers anytime in the lesson, immediately graded, and then used to provide instant feedback (Fazal, 2019). Then, the data collected can be sorted to allow teachers to make plans for future

learning. Just as instructional technology is used as an interface to implement differentiated lessons, it can be used as a tool to find and specify readiness levels and personal interests. Instructional technology creates an environment conducive to differentiation that is effective for all students and sustainable for teachers.

Responding to data. Differentiated instruction provides different paths for students to learn the curriculum, but it does not require teachers to prepare individual lessons for each student in the class (Tomlinson, 2017). When reviewing data, teachers identify areas of need and can create flexible groups. Flexible grouping implies that group members change grouping as needed to continue at their level of readiness. Within the flexible groups, each group member receives an assignment that will provide appropriate learning opportunities based upon cognitive readiness. There are times when group members collaborate and times when they do not. When using collaborative learning Tomlinson (2017) pointed out that peer tutoring is not considered a component of the differentiated classroom, so students who have mastered material should not be teaching other students. Instead, each student is engaged in the curriculum at his or her readiness level while the teacher takes the role of facilitator and helps those with questions as needed. The environment changes from the traditional teacher-centered environment to one that is student-centered (Holen et al., 2017).

Even though teachers in a differentiated class are not expected to create individualized lessons, implementing the differentiated approach can be cumbersome and time-consuming. One teacher who is trying to serve a class of students may find the stamina required unsustainable. However, using technology as an interface to integrate differentiation creates a sustainable environment for implementing differentiated lessons. Instructional technology is a tool that teachers can use to provide differentiated instruction to classrooms with students of mixed ability

levels (Sota et al., 2014). Instructional technology provides the flexibility needed to create a student-centered environment and allows teachers to become facilitators of education (Winter, 2018). As facilitators of learning, teachers can provide individualized attention to students as the need arises (Eteokleous et al., 2014). Each student gains access to the curriculum and instant access to the teacher in a differentiated environment that is employing the use of instructional technology. Help received through face-to-face interaction with a teacher or preloaded through smart software allows students to work in their ZPD, which according to Vygotsky (1978) leads to learning. Leaving the position as the giver of information and taking the role of facilitator begins with relevant data and responding to that data with strategic planning that creates a student-centered classroom where all can actively engage in the learning process.

Establishing routines. Routines and structures are an integral part of ensuring success for all students in the classroom. Foremost, teachers must organize the room and have an effective plan to manage behaviors (Lester, Allanson, & Notar, 2017). Students should be aware of this plan and general expectations to create an environment that is conducive to learning for all. Part of the plan should include organizing the room to support any differentiation that may happen for those who might benefit from moving as part of the learning process (Dicke, Elling, Schmeck, & Leutner, 2015). The environment should be set up ahead of student arrival and expectations clearly communicated. When students come to class, teachers should not assume an understanding of classroom routines. Routines, structures, procedures, and expectations should be taught, practiced, and modeled just as one would teach content (Myers, Freeman, Simonsen, & Sugai, 2017). Understanding routines is essential for effective differentiation and takes time to become part of students' natural patterns in the classroom.

Technology-driven classrooms are structured differently than a traditional teacher-centered environment. In an environment where everyone has their own device, teachers use instructional technology to connect students with learning opportunities, give feedback, and structure learning (Shaffer, 2015). Planning a well-managed environment that includes routine and procedural expectations of technology is essential for student success. Digital citizenship, troubleshooting procedures, and appropriate use of technology as designated by the issuing organization are among the 21st-century learning skills that should be integrated and practiced daily. Routines and structures will keep the environment learning-focused and give students the greatest chance for success. Teachers who have routines and structures appropriate for this environment will ensure all students understand expectations and have the freedom needed to complete self-directed tasks.

Student Achievement

Student achievement is a common theme that emerges when reviewing current literature on instructional technology use in education. According to a variety of research, using instructional technology in the classroom promotes differentiated instruction and has a positive impact on student achievement (Awada & Faour, 2018; Fabian, Topping, & Barron, 2018; Hoffmann & Ramirez, 2018; Yildirim & Sensoy, 2018). Student achievement is a complex mixture of different components working together that results in student success. To understand the breadth of student achievement, one must define achievement that occurs with versus without instructional technology, identify conditions for achievement when engaging students with instructional technology, and consider the role of training teachers on the integration of instructional technology.

Classroom achievement. Classroom achievement can be identified by measuring academic gains in students using instructional technology as opposed to those in traditionally taught classrooms. Ozerbas and Erdogan (2016) found that seventh-grade students in digital math classrooms outscored students who were in traditional classrooms in a short span of four weeks and attributed the results to increased motivation because students engaged more in technology-enhanced lessons. These findings were consistent with a meta-analysis of 24 articles that found instructional technology in mathematics led to higher academic achievement (Higgins, Huscroft-D'Angelo, & Crawford, 2019). Likewise, the integration of instructional technology has been associated with other groups of students and core classes. Awada and Faour (2018) found that ESL students in an English class made academic gains in both research skills and oral presentation as evidenced by higher grades than those who did not use instructional technology to support learning. Students who are engaged in curriculum supported with instructional technology have needed supports and scaffolds to experience academic achievement in a differentiated classroom.

Academic achievement may be connected to the level of engagement students have when interacting with curriculum supported by instructional technology, as well as the change of roles in the classroom. When using technology, students find the material more interesting, so they engage in activities that lead to learning (Thiele et al., 2014). As learning becomes more student-centered and students actively engage, teachers become facilitators with more flexibility to help struggling students individually (Holen et al., 2017). Teachers acting as facilitators rather than the givers of information can make changes for individual students as needed and create dynamic classrooms that allow for differentiated instruction (Winter, 2018). Because of the

efficiency of instructional technology, these changes can be made as quickly as needed, resulting in higher levels of student learning.

Active engagement of all students can lead to higher levels of motivation and more productivity in the classroom. While instructional technology increases student learning and motivation, interactive technology provides opportunities for differentiated instruction (Xin, 2015). Current research has linked a higher level of engagement to fewer behavior problems. Students who are fully engaged in classroom activities will experience more learning and display fewer problematic behaviors. Xin (2015) conducted research that found students in both math and English classes had fewer occurrences of problematic behaviors when using instructional technology in the form of clickers to support learning. Instructional technology enables teachers to easily implement differentiated instruction and engage students in relevant learning while reducing occurrences of disruption in the classroom.

Conditions for achievement. Instructional technology is impacting students' lives, giving teachers more sources for differentiating instruction and providing more choices for classroom inclusion (Tekedere & Goke, 2016). Although there are many choices available for teachers to incorporate, care should be given to what is chosen. When integrating instructional technology in differentiation, there should be an explicit purpose for the chosen technology to support learning. Technology should support instruction and should never be used as a quick add-on to a lesson just for the sake of implementing a new entertaining method (Thiele et al., 2014). Appropriate use of instructional technology will lead to effective learning for all students in the differentiated classroom and create the academic environment necessary for student achievement.

It is important that teachers ensure the technology integrated does not detract from the lesson or compromise academic achievement (Higgins et al., 2019). Reychav, Raban, and McHaney (2018) conducted a study that found students who were more vested in socializing than sharing information related to the lesson were distracted by the social construct used in the lesson and scored lower on the summative assessment as a result. While instructional technology supports learning, the purpose must be specific and designed so that students will succeed. Teachers must plan well and seek out technology that supports best practices in teaching and addresses the needs of students in the class before achievement for all readiness levels can occur.

Teacher training. Teachers should remain aware of emerging technologies that are relevant to the students they teach. To stay current, as new technologies emerge, teachers can seek out opportunities to learn how to use and incorporate them into instructional practices (Harris, Al-Bataineh, & Al-Bataineh, 2016). Teachers usually base their use of technology on knowledge level, and teacher comfort when using technology will depend on how the teacher has been exposed to using the technology. Kalonde and Mousa (2016) cite knowledge, training, and experience as factors that impact teachers' decisions to integrate technology. Teachers who are knowledgeable about how to support learning using instructional technology will integrate technology into best practices more often resulting in greater academic gains from their students.

Effective lessons lead to higher academic gains, and a key factor in the effectiveness of technology-based lessons for differentiated instruction is teacher knowledge and purposeful application of how the technology is used. When using instructional technology to support differentiated learning, teachers must be trained to use the technology and trained on how to incorporate differentiated strategies. Teachers are more likely to differentiate when properly trained (Bogen et al., 2019), and teachers who are properly trained to use instructional

technology will have students who experience the greatest academic gains when using technology (Young, Hamilton, & Cason, 2017). Properly training teachers in the purposeful use of technology is fundamental to the effective integration of instructional technology for differentiating learning that leads to student achievement.

Motivation

Motivation is defined as a system that describes how people choose specific behaviors and continue with those behaviors (McInerney, 2019). Current literature focuses on two vantage points of motivation regarding the topic of using technology for differentiated learning: teacher motivation and student motivation. Research regarding teachers focuses on what is best for student learning and preparing those students for the future, while the literature regarding student motivation centers on preparation for their future and the level of engagement achieved when using technology. Current studies support the assertion that instructional technology motivates students (Higgins et al., 2019) and allows teachers to become facilitators and create a student-centered environment (Winter, 2018).

Student motivation. Using technology to support differentiated instruction improves student motivation to engage in learning. Students use technology in many aspects of life outside of school and want to utilize it in the learning environment (Musti-rao & Plati, 2015). The integration of technology provides students an opportunity to learn with tools they are accustomed to using and leads to higher success rates (Ozerbas & Erdogan, 2016). Likewise, students have a belief that using technology will impact their futures positively (Hoffman & Ramirez, 2018). Students depend upon schools to guide them and educate them on technologies relevant to future success. Bulfin, Johnson, Nemorin, and Selwyn (2016) conducted an open-ended survey that found that over a quarter of students surveyed requested more guidance and

support using digital devices as applicable in education as the most needed area of improvement at school. The central belief that what is being done in class relates to life outside of school and is relevant to future success motivates students to work towards established learning goals.

Technology-enhanced lessons are more engaging than traditional methods and tend to increase student motivation (Higgins et al., 2019; Willacy & Calder, 2017; Xin, 2015). When using technology, students have higher levels of motivation in completing assignments and learning new material. A study conducted by Malacapay (2019) found that audio-visual effects associated with using technology for learning have been found to appeal to students of all learning modalities when properly used in lessons. With technology, students can see and experience concepts that are not otherwise attainable through other methods of study. Higgins et al. (2019) found that achievement and attitude are improved along with student motivation when teachers integrate technology. Ozerbas and Erdogan (2016) said that technology is more stimulating to see and hear than traditional methods; therefore, students are inherently more engaged. Higher levels of engagement are attributed to the increase in motivation from using instructional technology, which leads students to higher success rates in learning.

Teacher motivation. Since many factors impact sustained motivation for professional choices made by teachers, it is impossible to create a single list that applies to every educator. Some teachers are motivated by the belief that integrating technology into instruction and using technology in class is essential for student success in college and the workforce (DiCicco et al., 2016). Teachers are expected to teach students content knowledge and integrate that learning experience into a classroom community so that students are prepared for a world that demands skills beyond traditional learning. The collaborative nature of instructional technology presents opportunities for students to develop the social skills necessary to be successful in a society

outside of the classroom (Snape, 2017). The evaluation tool for teachers in Georgia, Teacher Keys Effectiveness System (TKES), includes a standard that evaluates how teachers create a positive climate as evidenced through cooperation among students. Some teachers are motivated by the ease with which purposeful collaboration can be included when using instructional technology. Likewise, teachers are experiencing a larger spectrum of diversity, and using one model to teach is no longer an option (Smets & Struyven, 2018). Given the amount of diversity present in the classroom, effective teachers plan with differences in mind and incorporate 21st-century learning skills into instruction (Obi et al., 2016). Planning differentiated learning using instructional technology allows teachers to create classroom learning communities that provide opportunities for all students to participate and prepare for the future.

Another motivation for integration is the learning environment created by technology. New opportunities for teachers to support diversity accompany the implementation of instructional technology. Instructional technology has made it possible for teachers who were not able to differentiate learning in the past to now bring this approach to the classroom. Gherardi (2017) conducted a study that found 68% of participating teachers agreed that technology changed the way their instruction was differentiated, and 69% agreed that differentiation was easier using technology. Technology has increased the resources teachers have available for instruction and has enabled differentiation in a way that did not exist in the past (Tekedere & Goke, 2016). When using instructional technology to employ a differentiated approach, teachers can take the role of facilitator and answer individual questions as problems arise (Eteokleous et al., 2014; Winter, 2018). Using instructional technology to differentiate learning makes the approach possible, creates an atmosphere of high student engagement, and changes the teaching role to one of facilitator.

Challenges

While the use of technology creates an environment conducive to differentiated instruction, there are challenges with integration. Integrating technology and implementing a differentiated approach are both accompanied by obstacles. When using instructional technology to support differentiated learning, the challenges can be compounded and overwhelm teachers with all levels of experience. Studies on differentiation that do not focus on instructional technology have shown that teachers are not implementing a differentiated approach, and those who do are doing so ineffectively (Cirasuolo, 2019; Tomlinson, 2016). When teachers do integrate instructional technology, there can be a discrepancy between what students expect and what teachers assign (Chou & Block, 2019). This and other factors provide challenges to teachers with all levels of experience. Educational literature examines internal and external factors that create challenges for teachers who want to do what is best for all students as they integrate instructional technology to develop differentiated lessons (D'Agostino, Rodgers, Harmey, & Brownfield, 2016; Kenney, 2016).

Internal factors. An internal factor that greatly influences teachers' choices to differentiate learning is teacher self-efficacy. Self-efficacy is a term that relates to one's belief about him or herself. Bandura (1977) introduced the term and since that time much research has been dedicated to understanding the importance of how what is believed is related to outcomes. Research positively links teachers' self-efficacy to the decision of differentiated instruction (Dixon, Yssel, McConnell, & Hardin, 2014). Belief in the ability to successfully differentiate is a large factor in a teacher's choice of a traditional or nontraditional approach. However, it must be noted that efficacy for differentiated instruction is associated with training and experience specifically in using a differentiated approach to teaching. Moosa and Shareefa (2019) completed

a study that found neither years of experience nor qualifications could be used to predict the use of a differentiated approach. Recommendations made from the study suggested that teachers should start training in using differentiated instruction as early as teacher preparatory programs. Teachers who believe they can successfully implement differentiation are more likely to do so.

Confusion over what is considered a differentiated approach is another internal factor that limits teachers' effective use of differentiation in the classroom. Teachers must have a clear understanding of how differentiated approaches are implemented before effective differentiation can be planned for and executed. There are misconceptions about what differentiated learning is and is not, so teachers struggle to effectively plan differentiated lessons (Ismajli & Imami-Morina, 2018). Tomlinson (2017) attributed the problem of not understanding what differentiation should be in the classroom to the number of years teachers have experienced undifferentiated instruction. If a teacher has not been properly trained for or exposed to effective differentiation, implementation can be very difficult and can leave teachers feeling uncomfortable with relinquishing so much control to students. Teachers require training on how to implement differentiated learning and how to identify strategies that are effective with their students (Aldossari, 2018). Knowledge of how to differentiate is linked to training and follow-up support after training is complete (Valiandes & Neophytou, 2018). The ability to differentiate learning begins with an understanding of how to identify the approach from other previously learned strategies.

Among the factors that hinder the ability to differentiate using instructional technology in a one-to-one environment is a lack of knowledge. Like strategies for differentiating, many teachers do not know how to effectively integrate technology into the learning space. Parrish and Sadera (2020) indicated that there is a lack of studies identifying the characteristics of those who

are navigating one device to each student successfully. Without a framework or model for teachers to follow, many are struggling to use technology to the fullest potential. Lack of knowledge and direction on full integration is evident in the instructional methods teachers are using to carry out technology-based assignments. The SAMR model, often thought of as a ladder, is available to help teachers effectively select and use instructional technology to support learning (Hamilton, Rosenberg, & Akcaoglu, 2016). SAMR stands for substitution, augmentation, modification, and redefinition. The bottom step of the ladder, or the lowest level of use, is substitution, which is where a teacher might simply upload a worksheet onto the Learning Management System (LMS). Further integration of technology continues up the steps to redefinition, the highest form of integration, at the top. Teachers continue to use technology at the substitution and augmentation level rather than the higher levels of modification and redefinition (Chou & Block, 2019; Crompton, Burke, & Lin, 2019). Instructional technology use that is suitable for all readiness levels cannot consistently remain in the lowest levels of learning since higher forms of integration allow teachers to create meaningful lessons that meet students' readiness levels, learning profiles, and personal preferences. However, a lack of knowledge on how to redesign lessons to integrate technology can be a major challenge for teachers.

External factors. School leadership is an important support for teachers in overcoming barriers to using technology in differentiated instruction. To effectively use technology, teachers need resources such as professional development and technical support, which require approval by the school administration (Harper & Milman, 2016). School systems should have strategic plans for the adoption of technology and training teachers to use newly purchased resources (Hanimoglu, 2018). Likewise, teachers must have technical support to smoothly integrate technology into lesson plans (Kalonde & Mousa, 2016). Having access to support increases the

teacher's chances of successfully integrating instructional technology. School leadership is responsible for ensuring that needed resources, training, and technical support are not obstacles to student learning. Without adequate resources and support in sustaining those resources, teachers are unable to effectively integrate technology or differentiated instruction.

Current literature indicates that the support of school leadership is positively related to teachers' reports of using differentiated instruction (Goddard, Goddard, Bailes, & Nichols, 2019). School leadership who creates a shared vision among the faculty supports positive student outcomes. Differentiated learning is effectively integrated more often when school leadership is involved and differentiation is utilized throughout the school (West & West, 2016). The effective use of technology to differentiate learning requires a clear understanding of what differentiation is and a fluency in the use of integrated technology that supports learning. Leadership who provides adequate training and support better equips teachers to differentiate learning for students of all ability levels.

Aftab (2015) conducted research that included a survey of 120 teachers, where only 13.3% reported believing they had enough time to effectively implement differentiated instruction, and only 15% reported believing they had enough time to plan for using a differentiated approach to teaching. While this did not include the use of instructional technology, these numbers represent the challenges teachers face regarding time and the role this disbelief may play in creating barriers to the use of differentiated learning with instructional technology. When thinking of the time requirement, many educators do not think holistically. While it does take time to prepare lessons for students with heterogeneous levels of readiness, it also takes time to remediate students and tutor them in one-on-one sessions at times outside of class (Tomlinson, 2017). The time that could be spent learning based on readiness level is spent

remediating because students are asked to work above their abilities, and time can be difficult to find when overwhelmed with meetings and duties. Using a differentiated approach provides students with a curriculum that matches their abilities and has the potential to stop the cycle of constant remediation of the same students. School leadership can give teachers time for planning, technical support, and the training needed for integrating differentiated learning using instructional technology.

Professional Development

Professional development is an accepted method of improving teaching practices and espouses the goal of improving teacher effectiveness in the classroom (Kennedy, 2016). Current research indicates that effective professional development improves the quality of education students receive (Kennedy, 2016; Lassig, 2015; Martin, Kragler, Quatroche, & Bauserman, 2014). Additionally, professional development is positively correlated with effective lesson planning that leads to student achievement (Baez-Hernandez, 2019). Throughout the literature, there is a resounding call for effective professional development in the implementation of differentiated instruction and technology use (Hussain, Suleman, Din, & Shafique, 2017; Moosa & Shareefa, 2019; Young, et al., 2017). Teachers integrating differentiated instruction benefit from professional development through improved efficacy, a clear understanding of how to differentiate, and learning how to effectively use technology to support learning.

Importance of efficacy. Self-efficacy is a belief in one's own ability to achieve. Bandura (1977) suggested this concept and said that self-efficacy is derived from four sources of information. Bandura credited performance accomplishments, vicarious experience, verbal persuasion, and physiological states as sources of information that impact one's central belief in accomplishing a task. How teachers see themselves as educators and evaluate their level of

effectiveness is impacted by personal experiences throughout their teaching careers (Moosa & Shareefa, 2019.) While all teachers benefit from effective professional development, teachers without experiences in differentiated instruction need professional development that creates experiences and models needed to raise efficacy. Professional development provides the knowledge teachers need to successfully implement a differentiated approach supported through the use of instructional technology in their classrooms (de Graaf et al., 2019).

Teachers require effective professional development to improve instructional practices in using technology to differentiate learning. Dixon et al. (2014) reported that teachers who have effective professional development feel more efficacy and are more likely to differentiate. Teachers who receive training on how to incorporate differentiated instruction feel more certain in their abilities to facilitate a differentiated approach in the classroom (Baez-Hernandez, 2019; Cirsuolo, 2019; Schipper, Goei, de Vries, & van Veen, 2018; Suprayogi, Valcke, & Godwin, 2017). Furthermore, effective training in differentiated instruction has proven to increase efficacy for teachers regardless of the school setting from where they come (Fabian et al., 2018). Professional development is essential in improving efficacy for teachers wanting to integrate a differentiated approach to learning.

Understanding the differentiated approach. Professional development for differentiated instruction is needed to clarify misconceptions related to defining differentiation. Bondie et al. (2019) conducted a literature review that analyzed 28 studies on differentiated instruction conducted in the United States over a 14-year period that included the years from 2001 to 2015. Bondie et al.'s findings indicated that there were common reasons for using the approach to instruction, but a discrepancy in how it was defined and described. Difficulty in defining differentiated instruction is the beginning of other misconceptions regarding how to

plan for and implement effective lessons. Tomlinson (2017) identified typical misconceptions of using a differentiated approach as unorganized classroom activity, a revamped grouping of the same ability levels, peer tutoring, and a differentiated approach only being needed for exceptional students. Teachers require effective professional development that outlines the parameters of what is considered differentiated instruction before they can effectively plan for and implement correctly for the benefit of all students.

Current research indicates that training should be given over time and should include follow-up support if it is to adequately meet the needs of teachers (Dixon et al., 2014; Valiandes & Neophytou, 2018). Time and practice are required for teachers who are asked to make changes in teaching strategies and integrate new approaches. Teachers who do not have adequate training and support are less likely to integrate the complex task of differentiating instruction into classroom routines (Bogen et al., 2019). Gaitas and Martins (2017) suggested that a professional learning community (PLC) can be effective in professional development because it creates an environment that allows teachers to learn differentiated strategies and support one another's professional growth. Hargreaves and O'Connor (2017) found that collaboration between teachers mostly consists of sharing ideas and is effective for improving best practices. Traditional professional development for differentiated instruction should be replaced with a blend of training sessions, follow-up support, and functional PLCs committed to the differentiated process.

Effective integration of technology. Instructional technology used in the classroom must be selected according to how effectively it supports learning and should not be selected based on popularity (Thiele et al., 2014). The methods teachers use to integrate technology impact student learning, so strategically planning the implementation is paramount to student

success (Lee, Longhurst, & Campbell, 2017). The universal use of technology in classrooms does not mean it comes without challenges. Technology that is not chosen wisely or implemented correctly can diminish the educational value of what is taught (Higgins et al., 2019). Professional development supports the effective use of technology that leads to student academic success (Blanchard, LePrevost, Tolin, & Gutierrez, 2016; Young et al., 2017). Educators must be trained not only in how to implement technology but should also be instructed on effective integration and possible pitfalls associated with its implementation.

Current literature has indicated that professional development is an ongoing process and not a one-time event that happens on days set aside by the school district for teacher learning. Lee et al. (2017) recommended that training sessions be extended over time and become an ongoing process that allows teachers the time needed to absorb new learning. Research conducted by Blanchard et al. (2017) indicated that student gains are best when teachers are trained over two to three years, with the largest gains occurring after three years. Professional development that is content-specific and includes a blend of synchronous and asynchronous learning environments for teachers is an effective means of providing both time and support required to successfully implement best practices when using technology (Belland, Burdo, & Gu, 2015; Dede, Eisenkraft, Frumin, & Hartley, 2016). Effective integration of instructional technology depends on how well the teacher understands the purpose and placement of the device or software in the learning process. Learning new pedagogy takes time and practice, so it is imperative that professional development is given over time and with follow-up support so that teachers master new teaching strategies.

Possible Pitfalls

Well-planned differentiated instruction using technology creates a student-centered classroom that changes the roles of teachers and students from those in traditional classrooms (Holen et al., 2017). This change of roles can have positive impacts on learning, but it should be approached with caution. Using technology without a clear purpose of supporting a relevant curriculum can have negative effects on learning. Students engaging in self-directed learning may lack executive functioning skills needed to stay on task, which creates a host of problems for learning and the learning environment. Teachers using technology to support instruction should establish accountability for students and eliminate distractions to the greatest extent possible (Aharony & Zion, 2019). Also, planning for technology-based learning should include time-appropriate activities for the age group so that students do not lose interest. Students who are asked to engage for longer durations or engage repetitively throughout the school year can lose interest even in high-engagement activities such as games (Beserra, Nussbaum, & Oteo, 2019). Helping students maintain interest and remain accountable for staying on task will keep the focus on learning.

Among the problems to consider when differentiating and using technology is the value system of students' profiles. Both literature and learning theory supports social constructivism; however, students must use the collaboration as time to learn rather than simply to socialize. A study by Reyhav et al. (2018) found that students who value socializing more than learning scored lower on assessments following a collaborative lesson using computer networking in class. Teachers who wish to integrate collaborative lessons as part of the differentiation process can predict this behavior and plan accountability interventions such as giving each student a specific role in the group or peer feedback forms. Having a well-planned lesson includes

strategies that will prohibit the loss of learning. Collaborative discourse enhances learning, but many students require guidance to successfully engage.

The physical layout of the room must also be conducive to the use of technology. When taking modalities of learning into consideration, teachers must consider and plan movement for kinesthetic learners, while differentiating for those who prefer visual or auditory styles (Dicke et al., 2015). Having a concise plan will lessen the possibility of distractions and chaos in the classroom. Additionally, teachers should plan the layout of the learning environment in a way that encourages students to engage in learning. Byers, Hartnell-Young, and Imms (2018) conducted a study that compared traditional classrooms to new generation learning spaces and found the physical arrangement of a classroom can impact how students and teachers use instructional technology. Teachers preparing to use technology for differentiated learning must consider student differences and include those in the plan to create a productive environment.

Summary

Students have always brought unique learning needs to the classroom, and the number of unique needs present continues to increase to larger proportions than ever before. Current literature supports the use of technology to differentiate instruction for students and argues that technology inherently creates opportunities for differentiated experiences (Jaleel & Anuroofa, 2017; Winter, 2018). Using instructional technology for learning fosters a student-centered environment where teachers become facilitators and, on a small scale, differentiation begins to happen as a result. Implementation of a differentiated approach requires strategic planning, but the use of instructional technology makes the task manageable. Teachers can use technology to instantly retrieve data and use that data to plan specific learning opportunities at students' readiness levels. Instructional technology is the interface that makes it possible for teachers to

serve a classroom of students at different readiness levels while acting as facilitators and creating an effective learning environment for all students.

Current Status

A review of the literature established how the integration of instructional technology increases student achievement, student motivation, ability to differentiate, and development of 21st-century learning opportunities (Dixon et al., 2014; Farisi, 2016; Jackson, 2017; Yildirim & Sensoy, 2018). Instructional technology creates opportunities for learning that did not exist in the past and supports learning for all students. Teachers can utilize technology to efficiently deliver instruction, practice sessions, remediation, and testing without standing over the shoulders of students. Instructional technology gives teachers the freedom to make choices that will engage students in meaningful one-on-one instruction at specific points where students may need more direct intervention to achieve mastery. While it is true that some students will have the same needs, it is not true that all students will have the same questions. Utilizing differentiated teaching through instructional technology integration is an effective approach for meeting many different needs and is supported in the literature review.

Given current research and available tools, teachers should use the traditional one lesson for everyone sparingly. “As we approach the end of the first quarter of the 21st-century, one-size-fits all teaching seems almost delusional” (Tomlinson, 2016, p. 6). The status of student diversity and the availability of technology should impact the way students learn. Teachers who continue to provide learning opportunities that are not differentiated using instructional technology will continue to have students who are not reaching their full potential. Current literature exposes the discrepancies that exist between how students should use technology and how it is implemented. Large gaps exist between theory and classroom application of best practices (Gurley, Peters,

Collins, & Fifolt, 2015). As student diversity and technology use in society continues to increase, teachers must change traditional methods to ones that match a dynamic world beyond school.

Using digital technologies is considered important by teachers and students (DiCicco et al., 2016; Hoffman & Ramirez, 2018). There is a general expectation that students learn skills relevant to the world in a way that will make them productive citizens after graduation. Those who support 21st-century learning argue that schools must educate students through collaborative experiences that require higher-order thinking (Bernhardt, 2015). The integration of the higher levels of the SAMR model, such as modification and redefinition, provides students with critical thinking opportunities that are necessary for 21st-century learning. Using instructional technology to differentiate learning provides students of all readiness levels opportunities needed to learn and develop skills that will propel them towards a successful future in a changing world.

Future Questions

While much is known about the benefits of differentiated instruction and the flexibility of using technology to employ such an approach to learning, some topics remain in question. One such area is the need to specifically define differentiated learning and 21st-century learning skills. Differentiated learning continues to be confused with other methods such as peer tutoring, homogenized learning, and individualized instruction (Tomlinson, 2017). Moving forward, there is a need for leadership to clearly delineate what differentiated learning is and is not as defined by a voice of authority such as Tomlinson. Also, teachers require clear direction on what is meant by 21st-century learning skills and how to implement them in class. Explicitly defining the needed skills and how those skills should be utilized in class is part of the solution (Bernhardt, 2015). Clear definitions and expectations will alleviate confusion and enable teachers to offer relevant curriculum using available technology. Teachers need an unambiguous model to guide

them through the convergence of differentiated instruction and technology integration in an increasingly diverse and technology-driven culture.

The need for professional development is expressed throughout the literature, yet questions remain about how to implement effective training for educators. There is a need for scaffolding professional development, but no clear way to do that is addressed (Smets, 2017). When reading current literature, it is easy to conclude that there is widespread agreement that effective professional development improves teaching practices (Kennedy, 2016; Lassig, 2015; Martin et al., 2014). However, there is little consensus beyond that point, which leads to confusion and interpretations of information that are often wrong. A plethora of questions remain to be answered regarding the implementation of professional development geared towards training teachers to differentiate learning using instructional technology.

Implications

This applied research project seeks to answer the question: “How can educators improve the use of instructional technology in differentiated learning for students at XYZ Middle School?” This study will benefit all students from the highest to the lowest cognitive abilities. While the students who are struggling the most at XYZ Middle School are those with disabilities, all students will benefit. Teachers use ability levels, student interests, and learning preferences to modify instruction for students (Smets & Struyven, 2018). Improving differentiation using technology will benefit all students as they are provided access to the curriculum in a relevant way, considering their readiness levels, interests, and learning profiles. Appealing to all groups of students will result in cognitive development and allow students to experience maximum learning and growth regardless of current placement. Extending the use of technology to

differentiate instruction will benefit all students regardless of the current level of readiness, since all students can be pushed to grow in their ZPD.

Finding answers to rectify the problem will have far-reaching benefits by providing a model for differentiation using instructional technology, identifying best practices for employing instructional technology as an interface in the classroom setting, and deciphering ways to provide support for teachers who are struggling to integrate differentiation using instructional technology. The culmination of these benefits will result in providing students relevant lessons at their readiness levels that are aligned to state-mandated standards and support 21st-century learning skills. This study is not only necessary for students at XYZ Middle School but is paramount to bridging a disconnect that remains between research and traditional classrooms regarding utilizing current research-based best practices (Gall et al., 2010). The arrival of Covid-19 has validated both a need for using instructional technology and the confusion related to using technology for instruction. Internet access issues, lack of teacher training, student confusion, and special education needs are among the plethora of challenges experienced since school districts first closed due to the coronavirus (Lieberman, 2020). While research supports the use of differentiation with instructional technology and students live in a time when there is a growing expectation to utilize technology in everyday life, there are many teachers who lead learning through traditional whole group methods. When antiquated practices are in place, students will not realize their full potential and graduate with the skills necessary to succeed in higher education or the workforce. This study will provide a model that others can follow to implement best practices in the use of instructional technology for differentiated learning.

CHAPTER THREE: METHODS

Overview

The purpose of this study was to improve the use of instructional technology in differentiated learning for students at XYZ Middle School and to formulate a solution that encouraged teachers to leverage the benefits associated with using instructional technology to differentiate. In 2016, XYZ Middle School implemented a one-to-one technology initiative that provided one Chromebook per student for use at school and home. While the availability of one-to-one learning has been consistent since that time, there was no evidence that one-to-one technology had been used to its full potential for differentiated instruction. Diversity had continuously increased over the previous three years, so strategies for learning needed to change to match the needs of the students attending the school. Since the implementation of one-to-one learning, the number of students who identified as Black, Hispanic, ESL, having disabilities, and economically disadvantaged had increased. Since the roll-out of one-to-one technology in 2016, student scores improved in all core classes as expected; however, state-mandated testing conducted in 2019 indicated that many students were not meeting basic grade-level standards necessary for academic success. In addition, large disparities existed between subgroups, which indicated a need for using the available technology to support a differentiated approach. This research was needed to find ways for improving differentiation so that all students can engage in the curriculum at their readiness levels and grow academically. This chapter includes details on research design, research questions, research setting, and participants. Information regarding the researcher's role, procedures, ethical considerations, procedures for data collection, and analysis of data are also explained.

Design

Applied research is used to solve a problem in practice. While there are different approaches to applied research, all applied research involves identifying a problem, creating a plan to collect data, collecting the data, reporting on findings, and identifying strategies to improve the problem (Bickman & Rog, 2009). This study sought to find an answer to a problem in practice at a specific location, so applied research was an appropriate choice. A multi-method design that incorporated both qualitative and quantitative data was used for this applied study. A multi-method design was chosen because it provided a comprehensive view of the problem. Bickman and Rog (2009) supported using both qualitative and quantitative methods to answer questions posed in applied research. Data collection included qualitative data from interviews with school leadership and a focus group and quantitative data from a survey of teachers.

Research Questions

Central Question: How can educators improve the use of instructional technology in differentiated learning for students at XYZ Middle School?

Sub-question 1: How can school leadership in an interview improve the use of instructional technology in differentiated learning for students at XYZ Middle School?

Sub-question 2: How can teachers in a survey improve the use of instructional technology in differentiated learning for students at XYZ Middle School?

Sub-question 3: How can teachers in a focus group improve the use of instructional technology in differentiated learning for students at XYZ Middle School?

Setting

Located in north-western Georgia, XYZ Middle School was a schoolwide Title 1 school that served 947 students in grades six through eight. The student population was 44% White,

32% Black, 15% Hispanic, 4% Asian/Pacific Islander, and 5% Multi-racial. In addition, 47% of the student population was identified as economically disadvantaged. The 2019 End-of-Grade testing indicated that only 50.8% of students were proficient in English and 51.2% were proficient in math. The school employed 59 teachers, eight support staff, and three administrators. Since 2016, the school had been one-to-one, providing each student with a device to use for the year both at school and at home. In addition to the device, each student was given a Google account that included access to Google Classroom, the school's LMS. The school used a middle school model utilizing true teams at each grade level. Teachers on teams shared the same students. Each team was led by a teacher who had been named as the leader. Grade-level teams met weekly to discuss student concerns and engage in cross-curricular planning. In addition, each discipline had grade-level PLCs that met each week to plan upcoming lessons. Every discipline had a department led by a chair who conducted meetings once a month to discuss concerns and upcoming changes. The size of the school, the increasing student diversity, the large disparity between certain subgroups in test scores, and the availability of technology for every student provided an appropriate setting to collect data for improving the use of one-to-one instructional technology to differentiate learning so that all students could receive grade-level assignments that match their abilities.

Participants

Participants included school leadership and teachers. There were three administrators who all held a professional certification and an administrative license. Of the 62 teachers, 51 were females, 11 were males, 25 held a professional certification, and 37 held a master's degree or higher. There is not much diversity in the faculty as 85% identified as White, 13% as Black, and 2% as Multi-racial. The teachers had an average of 13 years' experience teaching, and there

were three members on the support staff. There was no technology coach or instructional coach allocated to the school. Participants for both quantitative and qualitative portions of the study were chosen by purposeful sampling. According to Bickman and Rog (2009), purposeful sampling is a way to select participants who can provide information regarding a topic of interest that others are not able to provide. Focus group participants were recruited based on having been employed at the school at least three years, and teachers were invited to take the survey only if they were teaching a core class. Qualitative interviews were conducted with five members of school leadership: one from the school's administrative team, three department chairs, and one grade level team leader. Each possible candidate had been in classrooms throughout the building performing classroom observations, had been trained to mentor teachers, and had participated in leading professional development for the faculty. Exposure to other teachers' classrooms, a position as a mentor, and knowledge of school initiatives ensured each interviewee was a good candidate to provide the insight needed to conduct this study. According to Gall, Gall, and Borg (2007), the goal of purposeful sampling is to choose participants that can provide in-depth information to support the study's purpose. Teachers chosen for the focus group were purposefully selected based on their time at the school, knowledge of current practices, and grade level to ensure equal representation of current practices was reflected in the data. Grades six through eight had a total of 36 teachers of core classes, and an invitation email that contained the consent to participate in the survey was sent to all 36 teachers to solicit their participation. The criteria for heterogeneous input described by Bickman and Rog were met in this study because input sources included both administration and teachers.

The Researcher's Role

The motivation for this study stemmed from a firm belief that everyone deserves the

same opportunity to be educated. The fact that education changed the trajectory of my life has made me a strong advocate for teaching students so that all can grow academically. The researcher can be a source of bias in the study (Gall et al., 2010). There was a potential for researcher bias in this case due to strong personal beliefs that all students should be accommodated. My experience in teaching was comprised of inclusion, standard level, and advanced science classes at the middle and high school levels. Encounters with students of all levels of readiness have solidified my strong personal belief that all students can grow academically when properly accommodated. Also, I collected data from a school where I was a science teacher for a year. The teachers from whom I retrieved data were ones with whom I had worked. To eliminate my point of view and accurately reflect the participants' views in the study, bracketing was employed (Creswell & Poth, 2018). Bracketing can be used as a method to remove the researcher from feelings associated with an emotionally charged topic so that the emotions do not impact the validity of the study (Cutcliffe, 2003; Husserl, 1931; Tufford & Newman, 2012). Bracketing was accomplished through reflective memoing during data collection and analysis to ensure emotions were removed from the process (Cutcliffe, 2003). In addition, I used member checking throughout data collection and analysis. Member checking allows participants from which data was collected to verify the information retrieved and conclusions drawn to ensure credibility (Lincoln & Guba, 1985). Member checking was implemented to safeguard the credibility of this research.

Procedures

Immediately following a successful proposal defense, an Institutional Review Board (IRB) application was submitted and permission was granted to conduct this research study (see Appendix A for approval). A letter asking for consent to allow employees to participate was sent

to the district office of XYZ Middle School that explained the study and procedures. Before granting permission for research in a school, the district required a packet to be submitted. After receiving and reviewing the packet, approval was granted (See Appendix B for approval) and was added to the pending IRB application. Once permission was granted by both the IRB and district office, participants were recruited via email (see Appendices C, D, and E for emails) and received forms of consent that explained the study, their role in the study, and what would happen with data after the collection process (see Appendices F, G, and H for consent forms). Participants were informed that they could withdraw from the study at any time.

The study included procedures for protecting participants' identities to help them feel comfortable responding constructively and transparently. Protective measures were taken to ensure participants' anonymity so data could not be traced back to a specific person. Surveys did not include names or any information that could link the answers to a person; names were not recorded in the focus group or interview transcripts or data. Finally, all the data stored virtually was password protected. Creating a relationship of mutual respect provided the best chance for collecting data that was valid and would result in conclusions to help solve the problem in practice (Bickman & Rog, 2009).

To ensure the proper code of ethics was followed, all prior approval was received. Also, each participant received information that explained how and why the research was taking place, and all participants' identities were protected throughout the study. Finally, the study included member checking. All transcripts were transcribed by the researcher and verified by each participant. Themes and survey data were shared with the focus group as a source of member checking (Bickman & Rog, 2009).

This study included one quantitative and two qualitative methods of data collection. All

data was collected using Google® tools. Quantitative data was collected using a Likert-based survey housed on a Google Form®, emailed using the district email addresses, and analyzed for trends in responses. Qualitative data was collected through five interviews and a focus group using Google Meet®. The interviews and the focus group were recorded, transcribed, and shared with participants to ensure accuracy. To ensure the anonymity of all participants, names and any information that could identify candidates were not disclosed on any shared documentation, and all recorded information was stored in a password-protected computer. The interviews were scheduled one week in advance at the leisure of participants, and the focus group meeting took place after collecting the survey data. All interview and focus group questions were grounded in current literature and served to answer the study's research questions.

Data Collection and Analysis

Data collected included both qualitative and quantitative measures. Sources of qualitative data included interviews and a focus group, while quantitative data was collected using a survey. To ensure validity, all data underwent the process of triangulation (Gall et al., 2007). Triangulating data ensured all assessments were linked to specific data points that coincided with systemwide issues (Bickman & Rog, 2009). Codes, themes, and survey data were shared with the focus group as a means of member checking. If requested by district personnel, findings will be shared.

Interviews

The first sub-question for this study explored how members of school leadership in an interview could improve the use of technology for differentiation at XYZ Middle School located in Georgia. Interviews were a way to allow participants to discuss personal accounts and explanations of issues (Lambert, 2019). Interviews set up in advance included an administrator,

department leadership, and team leadership. Each interview was conducted using Google Meet®. Interview participants had a choice of Google Voice® or Google Meet®, and each chose Google Meet®. For this study, an interview protocol was used (Creswell & Poth, 2018; Rubin & Rubin, 2005) (see Appendix I for interview protocol). The format was semi-structured with preplanned probing questions. A semi-structured interview allowed probes to follow the structured questions prepared in advance (Gall et al., 2007). Interviews lasted 25 to 45 minutes and were recorded. The interviews started with three demographic questions regarding experience in education, highest degree obtained, and field of study. There were 11 main questions and five preplanned probes that were used to gain more information as needed (Rubin & Rubin, 2005). To ensure accurate transcripts, each participant was asked to verify what was typed after the interview was transcribed. The interview included the following open-ended main questions:

1. From your observations, how has one-to-one technology changed schoolwide instructional practices?

Instructional technology opens many learning paths for students to take in the acquisition of knowledge (Tahiri et al., 2017). This was a broad question that was intended to find any major changes that had taken place throughout most of the school. Rubin and Rubin (2005) suggested that the main principal questions start broad and continue to get more specific through the interview.

2. How does the one-to-one initiative support the mission and vision of the school?

XYZ Middle School promotes a vision of empowering students for success in life, and technology is a large part of life beyond K-12 education. Answers to this question help to explain leadership's view on the importance of instructional technology in the academic

success of students. “The power of shared mission, vision, values, and goals among school personnel to shape teaching and learning, i.e., the core technology of schools, is difficult to overstate and certainly worthy of continued focus and reflection” (Gurly et al., 2015, p. 239).

3. What safeguards are in place to ensure equity for all students when teachers use instructional technology in the classroom or for completing homework assignments?

This question focused on the equity of technology use. Equity must be addressed if all students are to be included in classroom learning experiences. To ensure digital equity, everyone must have equal access to hardware, software, and knowledge of how to use and apply the technology to learning (Resta & Laferriere, 2015).

4. What does differentiated instruction mean to you?

Differentiated instruction has been misunderstood and has lacked a clear definition among educators (Bondie et al., 2019). This question was intended to find similarities and differences in the viewpoints of school leadership and to gauge the possibility of a shared vision and common vocabulary.

5. Give specific examples of how you have observed differentiated learning supported by instructional technology in the school.

This question invited the interviewees to discuss specifically how differentiated learning using instructional technology looked in the school at the time of the interview. This question asked for specific examples from which a baseline could be created. Knowing the current use of instructional technology in differentiation was critical for developing the next steps for an improvement plan.

6. As an instructional leader, how do you encourage teachers to use instructional technology to meet the needs in mixed ability classes?

School leadership has a profound impact on the academic achievement of students and teachers' success in the school (Gurr & Drysdale, 2018; Orphanos & Orr, 2014; Sebastian, Allensworth, & Stevens, 2014). This question was designed to examine how leadership viewed their role in classroom pedagogy and how encouragement was given.

7. How are teachers trained through the school and district to use instructional technology to differentiate instruction?

Research shows that teachers who experience effective professional development are more likely to differentiate instruction (Dixon et al., 2014; Fabian et al., 2018).

Professional development is essential for improved integration of instructional technology in differentiated learning. This question provided information regarding professional development structures on both a school and district level.

8. What are some ways you model the use of instructional technology to differentiate learning expectations to the faculty?

Effective leadership models expectations (Kouzes & Posner, 2017). Answers to this question explained how leadership used opportunities to model to teachers how to use instructional technology for learning among mixed ability levels. Similar to students, teachers also have different ability levels and learning profiles. Leadership who acknowledges and celebrates the diversity of their teachers may encourage teachers to do the same in the classroom.

9. How do you assess technology needs among teachers?

Effective leadership identifies challenges and opportunities facing their organization (Gigliotti, 2019). This question was designed to create a discussion regarding procedures used to identify teachers' one-to-one implementation of best practices so that a plan to support and build upon those methods could be created.

10. What is your vision of how instructional technology can be used schoolwide to meet the needs presented by the growing diversity in the school?

According to school data, diversity had increased each year since one-to-one technology was implemented. There had been a decrease in the number of students who identified as White and an increase in the number of students who identified as Hispanic, Black, and Asian. In addition, the number of students identified as economically disadvantaged and having disabilities has increased. This question helped to create a solution for supporting the learning of all students.

11. Due to Covid-19, schools have been forced to rely more on technology for instruction. As the use of technology for instruction has increased in your school, what areas of strengths and challenges have you witnessed as a school leader?

The onset of the global pandemic closed many school districts and had a profound impact on how technology was used in classrooms. XYZ Middle School was among the schools that closed in 2020 and started the 2020-2021 school year virtually. This question gave insight into the challenges faced as a result of quickly pivoting to an online environment.

Pre-planned probes include the following:

1. Tell me more about...
2. Give me an example of...

3. For clarification, please explain...
4. Why do you say...?
5. How could...?

Rubin and Rubin (2005) suggested that probes be made in advance but should not be used after each question as to not annoy the interviewee. Follow-up questions were added as needed. Questions were designed to create interviews that provided thick data concerning leadership's view on differentiation and technology (Creswell & Poth, 2018).

Data analysis followed Creswell and Poth's (2018) suggestion that researchers develop codes, condense the codes into themes, and represent the data in a useful manner such as figures or tables. First, qualitative data were transcribed, shared via email, and verified by participants to ensure trustworthiness. After each transcript was verified, an initial read-through was conducted. Agar (1980) suggested that transcripts be read more than once before looking at individual parts, so the data will be read again with the researcher developing memos. Data was then coded through grouping together terms that were alike, as suggested by Creswell and Poth. Specifically, in vivo coding was used to ensure a direct connection to the exact language of the participants was preserved in the coding process. Direct words were pulled from the interviews in the order retrieved and categorized with similar ideas (Saldana, 2011). Finally, themes were identified and a visual display was created to help solve the problem in practice of not using instructional technology to the fullest potential in differentiated learning. Codes and themes were shared with focus group participants for member checking. Data collected from the interviews were triangulated with the focus group data and the survey data to provide a comprehensive

understanding of how to solve the problem in practice of not using instructional technology to the fullest potential in differentiated learning.

Survey

The second sub-question for this study explored how teachers in a survey could improve the use of instructional technology in differentiated learning. Before the survey was sent, two colleagues read over the questions to ensure clarity in the wording; however, the questions did not require any changes for accurate understanding. The survey was sent to 36 teachers of core subjects through an invitation email (see Appendix D). The email contained a consent link for those who wished to participate in the survey. Those who consented to participation clicked a link in the consent form that took them to the Google Form® containing the survey. Bickman and Rog (2009) suggested using official emails for survey distribution so all correspondence occurred through the official email addresses provided by the district. The survey began with two questions on demographics of participants to identify education level and years of teaching experience. Then, the survey provided 10 statements to which teachers used a four-point Likert Scale to respond. Survey questions include the following:

1. I use Google Classroom to make assignments for students to access in class.

Daily	Weekly	Monthly	Never
1	2	3	4

Implementing a differentiated approach is a cumbersome task without the use of instructional technology (Tahiri et al., 2017), and the use of a Learning Management System (LMS) supports a differentiated approach (Jackson, 2017). This question was important because answers indicated how often teachers were using the LMS provided by the district.

2. Students use their Chromebooks in class for learning new concepts.

Daily	Weekly	Monthly	Never
1	2	3	4

The use of technology has been shown to motivate students (Willacy & Calder, 2017; Xin, 2015) and positively impact student achievement (Higgins et al., 2019). In addition, the use of instructional technology is positively correlated to a longer retention of the curriculum than traditional methods (Yildirim et al., 2018). This question sought to identify how often teachers were using available technology for students. Data from this question was necessary for formulating a plan for the central question of this study.

3. I use instructional technology to differentiate lessons for students by varying assignments based on ability level.

Daily	Weekly	Monthly	Never
1	2	3	4

This question gave insight as to how many and how often core teachers believed they were using technology to differentiate learning in the content and process. This question was essential for identifying misconceptions that are common when defining differentiated learning (Bondie et al., 2019; Tomlinson, 2017). Comparing this question to more specific questions that followed revealed discrepancies in how differentiated learning was defined at XYZ Middle School.

4. I use instructional technology to give students choices on how to express their learning.

Daily	Weekly	Monthly	Never
1	2	3	4

Teachers are not limited to the acquisition of new curriculum when using instructional technology. Teachers can differentiate the product by allowing students choices in how they express what has been learned (Awanda & Faour, 2018; Tomlinson, 2017; Winter, 2018). This question was designed to find the number of teachers who were using instructional technology to differentiate the product. Instructional technology can deliver effective summative assessments and have the advantage of immediate feedback (Fazal, 2019).

5. I discuss and plan for accommodating students at all readiness levels using instructional technology with one or more members of my PLC.

Daily	Weekly	Monthly	Never
1	2	3	4

Teachers who differentiate learning experiences know their students' readiness levels and strategically plan lessons that engage students at their ability level (Smets & Struyven, 2018; Tomlinson, 2014). Meetings for PLCs were required once a week, although there were members who collaborated more often due to student needs in assigned classes. This question indicated how often discussion of using technology for accommodating students occurred.

6. I plan technology-supported lessons that accommodate a combination of students' audio, visual, tactile, and kinesthetic learning preferences.

Daily	Weekly	Monthly	Never
1	2	3	4

Teachers who plan differentiated instruction celebrate diversity through activities that include different learning modalities (Mahoney & Hall, 2017), and instructional technology can provide teachers opportunities to deliver differentiated lessons (Awada & Faour, 2018). This question specifically addressed the personal profiles of students and was an indicator of how many teachers planned learning opportunities supported through instructional technology with different learning modalities in mind.

7. I use instructional technology to administer formative assessments that guide lesson planning.

Daily	Weekly	Monthly	Never
1	2	3	4

Teachers use formative data to plan lessons that meet students' needs when using a differentiated approach to learning (Smets & Struyven, 2018). This question indicated how many teachers were using instructional technology to assess students' readiness levels and adjust plans accordingly. Formative assessments that reinforce learning by motivating students and supporting academic achievement are successfully distributed and accessed through instructional technology (Bhagat & Spector, 2017).

8. Using instructional technology to differentiate learning allows me to take the role of facilitator and provide support to individual students as I see the need.

Daily	Weekly	Monthly	Never
1	2	3	4

Data from this question was used to determine how many teachers were using technology to create student-centered environments where the teachers became facilitators of learning rather than givers of information. Instructional technology allows students to take more control of their learning and releases teachers to become facilitators available to help students as needed (Eteokleous et al., 2014; Holen et al., 2017; Winter, 2018).

9. I use instructional technology to provide remediation or interventions for students who have deficits in the content we are learning in class.

Daily	Weekly	Monthly	Never
1	2	3	4

Instructional technology is an effective way to accommodate students with disabilities and provide individual support (Mahoney & Hall, 2017). Using technology to differentiate instruction is a way to reach struggling students and allow them to engage in grade-level curriculum. This question was designed to gather data on how many teachers were using instructional technology for students who were struggling.

10. I use instructional technology to provide extension activities for students who have already mastered the material we are learning in class.

Daily	Weekly	Monthly	Never
1	2	3	4

Teachers report that differentiation is easier when using instructional technology (Gherardi, 2017). Extending students who have already mastered the curriculum is as much a part of the differentiated approach as remediation of those with gaps in learning. This question was designed to gather data on how many teachers were using instructional technology to extend students who had mastered content.

Before analyzing data, the number of teachers from each grade level was counted. The surveys were sent by grade level so that representation could be considered, but there was no way to connect a survey with any particular person so teachers could be comfortable answering honestly (Rog & Bickman, 2009). Discrepancies in the representation of grade levels were documented. Quantitative data was organized in an Excel® spreadsheet, checked for patterns, and averages on the frequency of each answer to each question were calculated. Descriptive statistics are useful in solving a problem in practice (Gall et al., 2010). Graphic displays using tables and graphs were created from data retrieved as described by Bickman and Rog (2009). The data gathered was used to identify areas of need regarding how technology was used in the classroom and misconceptions regarding how differentiated instruction was identified.

Focus Group

The third sub-question in the study explored how teachers in a focus group could improve the use of technology for differentiation at XYZ Middle School located in Georgia. Utilizing a focus group provided answers that were specific and directly related to improving differentiated

learning (Cary & Asbury, 2016). The group was used to bring clarity to the survey and provide essential information required as a follow-up to teachers' responses. Bickman and Rog (2009) noted that focus groups create an opportunity for researchers to communicate with participants directly and ask follow-up questions regarding the study. Focus group participants were chosen purposefully, used for clarification of survey data, and asked to expand on some related topics (Barbour, 2007). Since the focus group met virtually using Google Meet®, only six participants were selected; however, on the night of the meeting, only four were able to attend. Cary and Ashbury (2016) stated that a smaller group size encourages the level of interaction required for rich data in a virtual setting. Two individuals who had been teachers at XYZ Middle School for at least three years were selected to represent each grade level. On the night of the meeting, each grade level and core subject were represented. One-to-one was implemented in 2016, and teachers who had been at XYZ Middle School for at least three years were reliable sources of information regarding how technology use had changed over time, the professional development teachers had received, and additional supports that had been available. The advantage of using a focus group was that it allowed personal accounts to be shared (Gall et al., 2007). Personal accounts provided information on current practices and training in both instructional technology and differentiated instruction.

The focus group convened using Google Meet® to discuss the meaning of survey results and clarify other pending questions. While there are disadvantages to using online platforms to host a focus group, the small group size and previous relationship among the attendees and host lessened the likelihood that conversations were constrained (Carey & Asbury, 2012). Bickman and Rog (2009) suggested an interview guide that contains at least 10 questions be used by the moderator to guide the group. The focus group interview guide included 10 questions and

possible probes, ground rules describing expectations of professionalism, and a standardized welcome message that was read by the moderator (see Appendix J for focus group guide). In this study, the researcher was the moderator and guided the group through the questions for the duration of the group meeting. The meeting was recorded, transcribed, and verified by all participants before analysis. Like the interviews, data was analyzed through transcription, writing memos, coding, identifying themes, and creating a visual display (Creswell & Poth, 2018). Member checking was utilized to ensure no false conclusions were reached once the codes and displays were drafted.

The following questions were used to guide the focus group dialogue. The purpose of the interview guide was to open discussion that gathered information related to the topic studied; it was not a script (Bickman & Rog, 2009).

1. After reviewing the data shared with you from the survey, what trends did you notice?

This question was designed to gain feedback from the survey and provide clarity for any possible misconceptions (Bickman & Rog, 2009). A copy of the data was shared the day before the group met so focus group members could familiarize themselves prior to the meeting. After reviewing the data, probing questions were used to clarify initial thoughts.

2. How do students in your core area use instructional technology for learning?

For this study, instructional technology was defined as an instrument that allowed students to interact with the curriculum for learning (Christian et al., 2011; Liu et al., 2017; Sota et al., 2014). This question was designed to obtain specific examples of instructional technology already in place that met the criteria defined for this study.

3. How do students in your core area use technology to indicate learning has occurred?

To be adequately prepared for the workforce, students must be equipped with 21st-century skills (Jaleel & Anuroofa, 2017; Snape, 2017; Tomlinson, 2016).

This question was used to gauge how technology was used by students to create products of their learning.

4. How has the implementation of the one-to-one initiative changed the way your team provides instruction to students?

Research indicates that the implementation of one-to-one technology increases the use of differentiated instruction (Harper & Milman, 2016). This question allowed teachers to discuss how instruction had changed and to what degree the change included using a differentiated approach.

5. How do teachers in your subject area decide how and when to integrate instructional technology into unit lesson plans?

This question was designed to explore the extent to which teachers planned for the use of instructional technology to support learning. While instructional technology can be a powerful tool that supports learning, educators do not always understand the actual impact of its planned use (Higgins et al., 2019).

6. How does your team use instructional technology to reach students with mixed abilities in classrooms so that all students can engage in learning?

Research indicates that instructional technology can serve as an interface to accommodate students of different ability levels and create a student-centered classroom (Gherardi, 2017; Ozerbas et al., 2016). This question identified planning strategies currently employed by teachers in their PLCs and areas where support was needed.

7. What are some barriers that hinder the ability to differentiate learning using instructional technology for students in your teams' classrooms?

Teachers may experience intrinsic and extrinsic challenges when using instructional technology to differentiate learning (D'Agostino et al., 2016; Kenney, 2016). This question was designed to identify possible barriers teachers at XYZ Middle School face. This knowledge was essential for deciding the next steps for solving the problem in practice.

8. How has the implementation of one-to-one technology changed your role in the classroom?

Integration of one-to-one learning can result in teachers shifting to the role of facilitators as students have access to information and more control of their learning (Holen et al., 2017). Answers to this question gave insight into how technology had changed planning for instruction and role changes of the teachers because of the implementation of one-to-one technology.

9. What kind of professional development and follow-up supports have you received in the past three years that direct how you use instructional technology to differentiate learning in the classroom? This question will be followed up with: What kind of professional development has been most effective?

Professional development is essential for improving best practices (Baez-Hernandez, 2019; Cirusuolo, 2019; Valiandes & Neophytou, 2018) and is linked to greater teacher efficacy when differentiating instruction (Dixon et al., 2014; Moosa & Shareefa, 2019). This question identified training that was received and a need for follow-up supports.

10. What supports are needed for teachers to increase the current use of technology in differentiated learning?

Teachers who feel efficacious in their ability to differentiate instruction are more likely to do so (Dixon et al., 2014; Moosa & Shareefa, 2019). Identification of what is needed to create efficacy in teachers was paramount to formulating a solution for improving the use of instructional technology to differentiate learning.

Data collected from participants in this portion of the study provided valuable information in finding solutions to the problem in practice. After transcribing data and subjecting it to verification by participants, an initial reading was conducted. Then, a second reading took place, with notes made regarding key ideas as a means of documenting thoughts that transpired during the second reading (Creswell & Poth, 2018). Agar (1980) suggested that the researcher study the entire interview before breaking it into different pieces. In vivo coding was used, and the selected words of the participants were placed in the right margin with quotation marks around the words. The words were taken from the transcript, listed in the order of the transcript (Saldana, 2011). After reading through the transcripts two more times to verify important language extractions, the words were placed into categories that were studied and placed into themes, as suggested by Saldana (2011). Finally, a visual display was created to represent the focus group data (Creswell & Poth). Codes and themes were shared through email with members of the focus group for the purpose of member checking. No information was documented or disclosed that could identify any participant's identity. All recorded information was password protected and stored on a password-protected computer. To ensure validity, data from each instrument was triangulated through comparing codes, visual displays, and survey responses (Bickman & Rog, 2009). Triangulated data will be shared with the district if requested.

Ethical Considerations

After receiving approval from the IRB and school district, participants were invited to participate in the study using official district email. Those who agreed to participate received consent forms that clearly explained the procedures for the study. At all times, participants who chose to participate had the right to withdraw and were informed at every point of their involvement that participation was voluntary. Earning the trust of the participants came with the responsibility of ensuring that their trust was protected through honesty and ethical practices. The researcher attempted to promote trust through transparent communication and protection of all who choose to participate by keeping their identifying information confidential. Digital recordings of the virtual meetings were made through the use of Google Meet® and were password protected. All interview participants were given the choice of Google Meet® or Google Voice®, and each chose Google Meet®. Each interview participant was notified before recording started and made aware that cameras could be disabled for the interview. The focus group was scheduled for a Google Meet® session and was also made aware that cameras could be disabled for the meeting. All hard copy data was securely stored in a locked safe, and participants' identities will never be shared (Creswell & Poth, 2018). All recordings and hard copies will be stored securely for three years following the study.

To avoid researcher bias, bracketing was implemented by memoing during data collection and analysis (Cutcliffe, 2003). In addition, Creswell and Poth (2018) cautioned against a phenomenon called "going native." This pitfall occurs when the researcher takes a participant's view during data collection and results in a study that is not valid. Bracketing, setting clear boundaries for data collection, and member checking provided the best chance for results that do

not reflect personal bias and opinions. Member checking allowed for continuous communication to reduce misconceptions regarding data interpretation.

Summary

XYZ Middle School, located in Georgia, was a schoolwide Title 1 school that served students of many different readiness levels and was continuing to increase in diversity. The school was one-to-one, providing each student with a computer to use at home and school. This applied research multi-method design study sought to solve a problem in the practice of using technology to differentiate learning. The study included qualitative and quantitative data that was analyzed using a variety of established methods and triangulated for validity. Before data collection, approval from the IRB and school officials was received, participants were chosen, and consent forms were signed. The purpose of this study was to improve the use of instructional technology in differentiated learning for students at XYZ Middle School and to formulate a solution that encouraged teachers to leverage benefits associated with using instructional technology to differentiate instruction.

CHAPTER FOUR: FINDINGS

Overview

The purpose of this study was to improve the use of instructional technology in differentiated learning for students at XYZ Middle School and to formulate a solution that encouraged teachers to leverage the benefits associated with using instructional technology to differentiate. The problem was the insufficient use of one-to-one instructional technology to differentiate learning so that all students could receive grade-level assignments that matched their abilities in a middle school. This chapter includes a description of the participants, the results and themes identified from interviews, surveys, and a focus group, and a discussion of the findings. The analyzed data answered the following research questions:

Central Question: How can educators improve the use of instructional technology in differentiated learning for students at XYZ Middle School?

Sub-question 1: How can school leadership in an interview improve the use of instructional technology in differentiated learning for students at XYZ Middle School?

Sub-question 2: How can teachers in a survey improve the use of instructional technology in differentiated learning for students at XYZ Middle School?

Sub-question 3: How can teachers in a focus group improve the use of instructional technology in differentiated learning for students at XYZ Middle School?

Participants

This study consisted of participants from a middle school in Georgia who were chosen by purposeful sampling. Five members of school leadership were interviewed, 36 core teachers were invited to respond to a survey, and four teachers participated in a focus group. All focus group members were teachers who were certified to teach core classes and had been employed at

the middle school being studied for at least three years. Participants in the interview and focus group were assigned a pseudonym to protect their identities. See Table 4 and Table 5 for demographic information of interview and focus group participants.

Interview Participants

Five members of school leadership were interviewed. All participants had extensive experience at XYZ Middle School and were part of the one-to-one technology implementation. Four of the five interviews were with teachers who served in a leadership position at the middle school at the time of the interviews, and one interview was with an administrator. Of the four teachers, two of the teachers were department chairs when interviewed; one was a grade-level team leader when interviewed; one was the leader of the gifted and talented program when interviewed. In addition, the teachers were members of the school leadership team, and three served on the school improvement committee at the time of the interviews. One interview was with an administrator who served in the capacity of assistant principal. There was an average of 25 years of experience in education among the five participants. Two participants identified as Black and three identified as White. Four of the five interviewees were female. All interviews were one-on-one and were conducted using Google Meet®.

Table 4

Demographics of Interview Participants

Participant	Gender	Experience
Administrator 1	Female	28 years
Teacher 1	Female	41 years
Teacher 2	Female	10 years
Teacher 3	Female	30 years
Teacher 4	Male	17 years

Administrator One. The first interview participant was an administrator at XYZ Middle School and had been in that role for more than 10 years. This interview participant had 28 years

of experience in education and had a background in early childhood education. After working as a classroom teacher, she completed an Ed.S. in Leadership and served as an assistant principal at XYZ Middle School.

Teacher One. The second interview participant was a teacher in a leadership position at XYZ Middle School. She completed an Ed.S. in Curriculum and Instruction. She had 41 years of teaching experience, taught all levels of her core content area subject, and had held many different leadership positions during her time at XYZ Middle School. She was a department chair and a member of the leadership team and school improvement committee at the time of the interview.

Teacher Two. The third interview participant was a teacher at XYZ Middle School. She had an undergraduate degree in Biology, an M.Ed. in Science Education, and an Ed.S. in Curriculum and Instruction. She had been in education for 10 years. Teacher Two was a department chair. She was a member of the leadership team and school improvement committee in addition to serving as a classroom teacher of a core subject.

Teacher Three. The fourth interview participant was a teacher at XYZ Middle School and had been since the day it opened. She had been in education for 30 years. Her undergraduate and graduate degrees were in Education, and her highest degree was an Ed.S. Throughout her tenure, she had served in many different leadership capacities at the school, including department chair in the recent past. At the time of the interview, she was the lead teacher over the gifted and talented program at XYZ Middle School. She was also a member of the leadership team and the school improvement committee. She served as a classroom teacher of a core subject and taught both inclusion and gifted and talented classes.

Teacher Four. The fifth interview participant was a teacher at XYZ Middle School. He

was a career switcher and had been in education for 17 years. After serving in administration level management in the private sector for more than 20 years, he completed an M.Ed. and became a teacher. He served in a variety of leadership roles throughout his 17 years at XYZ Middle School. He was a grade-level leader, a member of the leadership team, and a member of the school improvement committee. He also served as a teacher mentor and taught as a classroom teacher of a core subject.

Survey Participants

The quantitative survey instrument (see Appendix K) was sent to all teachers who taught core classes at XYZ Middle School during the 2020-2021 school year. Core teachers received the survey instrument through their district email with a follow-up email sent to remind them of the last date to participate. Of the 36 invitations sent, 16 teachers chose to participate (44% response rate). There were nine sixth-grade teachers, three seventh-grade teachers, and four eighth-grade teachers who chose to participate. Four of the participants had an Ed.S., six had an M.Ed., and six had a bachelor's degree. The average number of years of teaching experience among participants was 11.

Focus Group Participants

Focus group participants were required to have been employed at XYZ Middle School for the past three years and teach a core content area class. Eligible teachers were invited to participate via email, and the first six to volunteer were chosen. Though six teachers were chosen, two had to cancel on the night of the meeting. The focus group convened with four teachers. All grade levels and subject areas were represented in the group. The group convened using Google Meet®.

Table 5

Demographics of Focus Group Participants

Participant	Gender	Subject Experience	Teaching Experience (Years)
Teacher 1	Female	ELA	8
Teacher 2	Female	Science	15
Teacher 3	Female	Math	4
Teacher 4	Female	ELA, Social Studies, Special Education	14

Participant One. Ms. Stone (pseudonym) was an English Language Arts teacher with eight years of experience teaching high school and middle school. Prior to teaching for XYZ's school district, she was employed by a neighboring school district. She taught sixth-grade English Language Arts since accepting employment at XYZ Middle School.

Participant Two. Ms. Collins (pseudonym) was a science teacher with 15 years of teaching experience in two counties in central Georgia. She had experience in teaching inclusion, general education, and gifted and talented science courses. She taught sixth-grade science since accepting employment at XYZ Middle School.

Participant Three. Ms. Wilkins (pseudonym) was a math teacher with three years of teaching experience in grades six through eight at XYZ Middle School. She also had experience in teaching at a Montessori school and had worked in the private sector for a software company leading professional development for teachers in schools that purchased the company's software. She led the professional development of teachers in the use of the company's software and using that software to support differentiated instruction.

Participant Four. Ms. Adams (pseudonym) was a core teacher who was endorsed to teach middle school English, social studies, and special education. While she had 14 years of experience teaching sixth, seventh, and eighth-grade English Language Arts and seventh-grade

social studies, she taught seventh-grade and eighth-grade English Language Arts classes, which consisted exclusively of students with autism for the 2020-2021 school year.

Results

Both qualitative and quantitative methods were used for this study. First, semi-structured interviews with school leadership were conducted to retrieve data regarding their experiences related to differentiated learning using instructional technology at XYZ Middle School. Second, a quantitative survey was sent to core area teachers to see how they were using technology in learning and differentiated instruction. Finally, a focus group made up of teachers convened to elaborate on the survey and discuss topics associated with using instructional technology to differentiate learning. Interviews and focus group meetings were transcribed and verified by participants. Then, the transcripts were coded to find themes. The surveys were analyzed for frequency of answers and percentages of answers by each question, and themes were identified. Themes from interviews, surveys, and the focus group were triangulated for validity (Gall et al., 2007).

Sub-question 1

Sub-question one for this study was, “How can school leadership in an interview improve the use of instructional technology in differentiated learning for students at XYZ Middle School?” Interviews were conducted with school leadership from XYZ Middle School using Google Meet® to find themes related to using technology to differentiate instruction. The researcher used a semi-structured format that allowed for follow-up probes when needed. Data analysis followed Creswell and Poth’s (2018) suggestion to develop codes, condense the codes into themes, and represent the data in a useful manner such as figures or tables. After the interview, the transcripts were transcribed and verified by participants. After participants verified

the transcripts, the researcher read through the transcripts once completely without any analysis. During the second reading, the researcher's thoughts regarding the information were recorded in the form of memos. After memoing, the transcripts were read again. During that reading, direct words were pulled from the interviews in the order retrieved and categorized with similar ideas (Saldana, 2011). The transcripts were read through two more times to verify that significant words and phrases were chosen. After completing this process for each interview transcript, all the identified words and phrases were combined in one document. The researcher looked for patterns and topics that reoccurred in each interview to create codes. The frequency of codes can be seen in Table 6.

Table 6

Frequency of Interview Codes

Code	Frequency
Needs	19
Technology	15
Students	10
Teachers	9
Covid	8
Differentiation	7
Activities	6
Parents	6
Leadership	5
Opportunities	5
Communication	5
Resources	4
Vision	4
Special Education	4
Virtual	3
Communication	3
Immediate Access	3
Truancy	2
Parapro	2

The codes were compared among the interview participants and then grouped to develop themes.

The themes that emerged from the qualitative data analysis were benefits of one-to-one technology, needs, conflicting viewpoints, and special education, as indicated in Table 7.

Table 7

Interview Codes Grouped into Themes

Benefits of One-to-One Technology	Needs	Conflicting Viewpoints	Special Education
Resources	Students	Differentiation	Parapro
Activities	Teachers	Leadership	Truancy
Opportunities	Covid	Vision	
Communication	Parents		

Theme #1: Benefits of one-to-one technology. Throughout each interview, the benefits of one-to-one technology were repeatedly discussed. The most widely discussed benefits of using instructional technology were available resources, engaging activities, learning opportunities, and instant communication. Prior to the integration of one-to-one technology, teachers were limited in each of these areas, and interview participants celebrated the benefits that came with school-wide integration.

The most discussed benefit of one-to-one technology was the available resources that accompany school-wide access to computers. Administrator One said, “They have immediate access to the web with a wealth of information, and of course games along with other learning materials and resources.” With excitement, Teacher Three pointed out, “There are amazing resources.” Teacher Three specifically discussed using Physics Education Technology (PhET) and Quizizz during the interview. PhET is a virtual lab software that provides online interactive science lab experiences for students, and Quizizz is a game that collects data on the questions

that students answer. Teacher One said, “Also, we are doing a lot of things with Nearpod.”

Nearpod is interactive presentation software that allows teachers to involve students through questions, collaboration, videos, and games. PhET, Quizizz, and Nearpod are free online tools that encourage the active engagement of students throughout the learning process. Teacher Four said, “I mean you could go nuts with the stuff that is available for these kids to make it interesting, to make it relevant.” Throughout each interview, technology resources were woven into the conversation.

Activities and opportunities for learning were discussed as benefits of instructional technology. The ability to create a student-centered environment and connect students to information that is time-relevant through available activities was specifically addressed. Teacher Two said, “Just having examples. You can go to different programs like in math. If you want to teach them two-digit multiplication, they get to have examples showing them how to.” Administrator One noted, “You may have a platform for a discussion or two or three discussions going on all meeting the same standard but maybe with different questions, and then the kids present that.” Explicit instruction through programs, the flexibility of classroom activities, and relevant information were discussed as activities and learning opportunities that students have as a benefit of using one-to-one learning at XYZ Middle School.

Finally, there was a discussion of how one-to-one technology opened lines of communication between students and the curriculum. In the interviews, communication in the form of immediate feedback was discussed. Administrator One spoke of an online game used in a math class and said, “Students will get immediate feedback if their answers are correct or if they are incorrect.” Teacher Three said, “A lot of them are graded for you, like with USA Test prep, Ed Puzzles, and things like that.” One-to-one technology allows students to have

immediate feedback regarding the understanding of the curriculum. Likewise, teachers were able to connect students who were not at school on a given day to what was learned in class. Teacher Two said, “We post a video every day of our lesson on a website that the school has up that is called EHub. Every teacher has a website hooked to XYZ Middle School, and the students can go day by day.” Immediate feedback and connecting students to the curriculum were discussed as communication supports when using instructional technology.

Theme #2: Needs. The second theme to emerge was needs. There were many needs discussed throughout the interview process. Administrator One pointed out that teachers need continued support when she said, “It’s ongoing to me, the differentiation, I don’t think we are quite there yet. I think that continued support is needed, and we just have to continue working on that work.” Teacher Two spoke of the struggles new teachers face. She said, “So, every year with a first-year teacher, I don’t think actually differentiating at that level is a reasonable expectation because they don’t have their resources. They have to get their feet on the ground.” The teachers interviewed referenced workload and fatigue in many of their responses. Teacher One said, “They just keep adding more, and you have to get to a point so that you don’t have cyberspace overload. You have to only implement a couple of things at a time.” The administration expected that teachers use Nearpod, USA Testprep, and Google Tools in the classroom and provide differentiated instruction as outlined by TKES. To prevent the “cyberspace overload” described by Teacher One, teachers needed training and continued support with how to use Nearpod, USA Testprep, and Google Tools to differentiate learning for students of all ability levels.

Students’ needs were also a topic discussed. Teacher One said, “We have to come up with some supports for students who really struggle.” Some of the struggles could be explained by off-task behaviors, suggested Teacher Three, “So, it is a lot of monitoring behavior and

making sure they are on task. Before with paper and pencil, they were either doing the work or not doing the work.” Teacher Four also discussed issues with students’ off-task behaviors by stating, “Well, in my own negative way, I think we have given them game machines.” Finding ways to support students in their appropriate use of technology and the ability to engage in the curriculum was a resounding theme throughout the interviews.

Likewise, needs regarding the use of technology that resulted from the Covid-19 Pandemic were discussed. The school implemented a concurrent model where teachers teach in-person students face-to-face and online virtual students simultaneously. Student grades, attendance, and participation have suffered as a result. Administrator One said of those students who are online, “A setback for it is the students who struggle, they are lost. They are really lost.” Then when speaking of parents, she added, “Parents are admitting, they don’t know what to do, so they (students) are getting further and further behind.” Teacher Three supports this assertion by saying, “I mean we have students with zero averages. They are not doing work; they are not coming to class.” Speaking of the concurrent model, Teacher Four said, “We are ticking all the boxes, and we are doing all the right things.” Then he went on to speak of the impact this had on all students. He said, “I have found that many students who are doing their assignments are not getting what they need to, and my assessment grades are much lower across the board than normal.”

Theme #3: Conflicting Viewpoints. The third theme to emerge from the interviews was the difference in how differentiated instruction was defined and leadership models were employed. When asked to define differentiated learning, participants articulated different ideas. Administrator One: “For me personally, it is simply meeting the needs of each of the students.” Teacher One: “Differentiated learning to me: You are not only looking at it by choice, and you

are looking at it by content.” Teacher Four: “Theoretically it should be that you are tailoring everything to the student based on their IEPs or whatever you have.” Definitions of differentiated instruction varied between individualized instruction, tiered learning, and accommodations defined in IEPs.

There were also different approaches to the leadership models used to encourage teachers to use instructional technology in differentiated learning. Teacher One said, “I am one of those who tries to lead by example, and I model what I expect.” Teacher Four said, “So, my thing is that I only try to bring them (teachers under his leadership) in occasionally and ask them how it is going.” Administrator One explained how the administration identified needs and encouraged technology use for differentiated instruction when she said, “We try to get input from teachers as to what their needs are, but we see the needs and go ahead and establish some of the things we need like differentiation technology uses.” The participants did not indicate any structured plan or expectations of school leadership when encouraging the use of instructional technology in general or in differentiated instruction. During the interviews, there was no shared vision of a differentiated learning or leadership model that prevailed.

Theme #4: Special education. The final theme that emerged in data analysis was special education. Special education was spoken of as though it is a separate placement for students rather than a service as described by the Individuals with Disabilities Education Act (IDEA). Teacher Four said, “Now the only real differentiation I can do at this point is with my sped class. I do have a parapro (teacher’s assistant) who takes the children into what we call, small group.” Teachers interviewed projected the idea that they were not qualified to plan for students with IEPs. While talking about differentiation, Teacher Three said, “I have two regular ed and two gifted, but even within those, in one class I have five autistic kids. So, meeting that need, we

work closely with special ed where there are modifications.” Rather than being a part of the general education population, special education students were spoken of as though they were set apart for special education teachers to teach. Teacher Two said:

The special ed kids, very few of them are in class. They are at home. You know Mrs. Tack (pseudonym). She is pulling her hair out because she is all over those kids, and it is like I am doing what I am doing. I am sorry, but if they don’t show up, I can’t do anything about it.

In this case, only a special education teacher who is not part of the class is contacting home, rather than the student’s general education teacher. General education teachers projected a feeling of despair and uncertainty when dealing with special education needs both online and in person. The idea that only special education teachers were qualified to work with special education students prevailed throughout the interview process.

Sub-question 2

Sub-question 2 for this study was “How can teachers in a survey improve the use of instructional technology in differentiated learning for students at XYZ Middle School?” To answer this question, surveys were sent to teachers of core classes using their district email addresses. The initial invitation to participate was sent out, and a follow-up email was sent a week later to remind those who wanted to participate to do so before the survey closed. There were 36 invitations sent, and 16 teachers chose to participate. During the leadership interviews, teacher workload due to the pandemic was addressed by two of those interviewed, so it might be that the participation rate of 44% could be related to workload and the special circumstances of this school year, since teachers of XYZ Middle School were teaching online and face-to-face simultaneously. See Table 8 for the results of the survey.

Table 8

Frequency of Answers and Percentages of Survey Questions

Question	Daily	Weekly	Monthly	Never
I use Google Classroom to make assignments for students to access in class.	13 81.25%	3 18.25%	0 0%	0 0%
Students use their Chromebooks in class for learning new concepts.	15 93.75%	1 6.25%	0 0%	0 0%
I use instructional technology to differentiate lessons for students by varying assignments based on ability level.	5 31.25%	8 50%	3 18.75%	0 0%
I use instructional technology to give students choices on how to express their learning.	6 37.5%	10 62.5%	0 0%	0 0%
I discuss and plan for accommodating students at all readiness levels using instructional technology with one or more members of my PLC.	3 18.75%	11 68.75%	2 12.5%	0 0%
I plan technology-supported lessons that accommodate a combination of students' audio, visual, tactile, and kinesthetic learning preferences.	4 25%	8 50%	4 25%	0 0%
I use instructional technology to administer formative assessments that guide lesson planning.	4 25%	12 75%	0 0%	0 0%
Using instructional technology to differentiate learning allows me to take the role of facilitator and provide support to individual students as I see the need.	7 43.75%	5 31.25%	4 25%	0 0%
I use instructional technology to provide remediation or interventions for students who have deficits in the content we are learning in class.	5 31.25%	6 37.5%	5 31.25%	0 0%
I use instructional technology to provide extension activities for students who have already mastered material we are learning in class.	3 18.75%	8 50%	4 25%	1 6.25%

After analyzing the survey data, four themes emerged: (a) accessing the content, (b) teacher use of provided software, (c) planning for extension activities, and (d) there was more time planning than executing differentiated instruction using technology.

Theme #1: Accessing the content. The most common use of technology reported was in how students accessed information. Questions one and two received the highest frequency response (daily), which referred to the use of technology to access class content (see Figure 1).

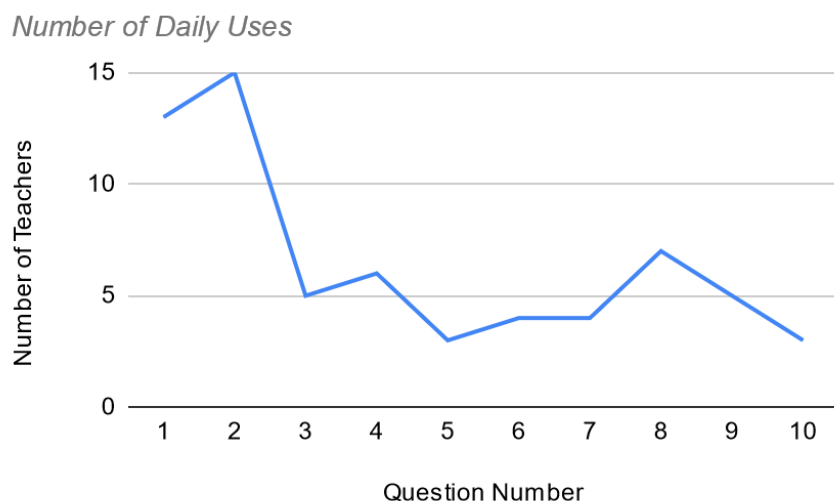


Figure 1. Frequency of Daily Responses by Question Number

Questions one and two had the highest percentage of daily use of all the questions asked, indicating that instructional technology is most often used for accessing the content. For question one, 81.25% of the teachers surveyed said they used their Google Classroom Learning Management System (LMS) daily, and 93.25% of the teachers reported daily use of computers for learning new material (see Table 8). Teachers at XYZ Middle School were simultaneously teaching students virtually and face-to-face and were required to make instructional videos and upload materials daily for at-home students. The large number of teachers who reported using technology daily for accessing lessons could have been encouraged to do so due to this teaching model. The use of technology as a resource for accessing content was also a theme that was present in the interviews and the focus group meeting.

Theme #2: Teachers were using the provided software. Question three illustrated that half of those surveyed reported using instructional technology weekly to differentiate learning, and 31.25% said that they use instructional technology to differentiate daily (see Table 8). In the focus group, teachers stated that they were required to give formative assessments using USA

Testprep once a week. Then, they were required to give students time to work on areas of deficit using the modules provided in the program either in class or as a homework assignment on a daily or weekly basis. The focus group reported that this required use of USA Testprep provided a means of differentiating learning using instructional technology weekly (see Figure 2).

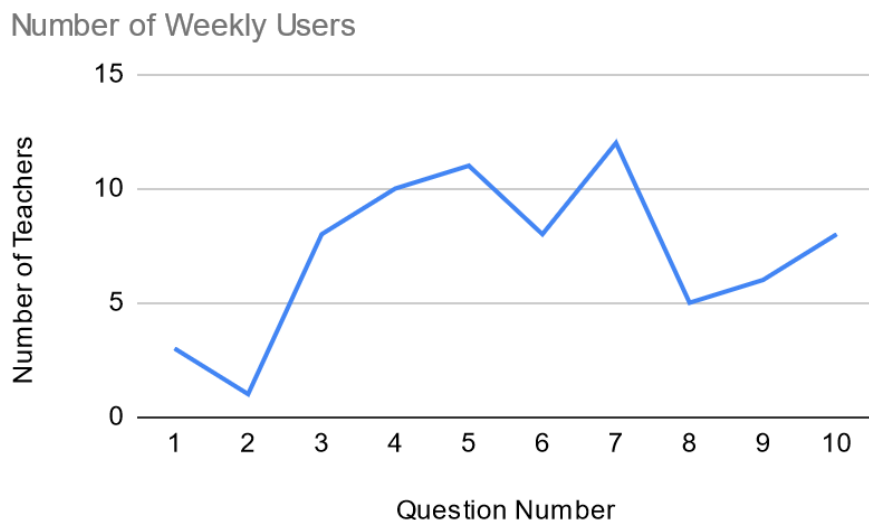


Figure 2: Frequency of Weekly Responses by Question Number

Further, 31.25 % of the teachers reported using instructional technology daily for remediation, whereas only 18.75% reported using it daily for extension activities (see Table 8). Considering this data alongside what was gathered during the focus group, USA Testprep was used for remediation and not extension activities. The number of teachers who reported weekly and daily use of differentiated instruction indicated that more than half of the teachers are using the program provided as required by the school administration (see Figures 1 and 2). This theme was also prevalent in the focus group meeting.

Theme #3: Planning for extension activities. While PLC meetings are required once a week, in question five, 18.75% of the teachers surveyed reported planning with their PLC every day regarding differentiated instruction. In question nine, 31.25% reported using instructional

technology for remediation, and only 18.75% reported using instructional technology for extension activities daily (see Table 8). The number of teachers who reported daily planning with their group matches the number of teachers who reported using instructional technology for extensions daily. While a narrow margin of teachers reported using technology for extension activities daily, there seems to be a correlation to more organized planning time for those teachers. This theme coincides with and supports the assertion that most teachers consider the use of USA Testprep differentiated learning using instructional technology, even though it is only for remediation. Differentiated learning targets students of all readiness levels, including those who have mastered the curriculum and are ready to progress. According to the survey data, teachers who are truly differentiating and not just remediating are engaging in more organized planning time.

Theme #4: Teachers spend more time planning for differentiated lessons than executing differentiated lessons using technology. Questions nine and 10 surveyed how often teachers use instructional technology for remediation and extension activities respectively. In response, 68.75% of the teachers reported using instructional technology in a combination of daily and weekly percentages for both remediation and extension activities. This percentage is lower than those who reported planning for the use of differentiated learning using instructional technology. In question five, 87.5% of the teachers reported planning with their PLC daily or weekly, and in question six, 75% reported planning for learning preferences on a daily or weekly basis outside of their PLC (see Table 9).

Table 9

Daily and Weekly Totals of Planning vs Use of Differentiated Instruction

Question	Daily	Weekly	Total
I discuss and plan for accommodating students at all readiness levels using instructional technology with one or more members of my PLC.	3 18.75%	11 68.75%	14 87.5%
I plan technology-supported lessons that accommodate a combination of students' audio, visual, tactile, and kinesthetic learning preferences.	4 25%	8 50%	12 75%
I use instructional technology to provide remediation or interventions for students who have deficits in the content we are learning in class.	5 31.25%	6 37.5%	11 68.75%
I use instructional technology to provide extension activities for students who have already mastered material we are learning in class.	3 18.75%	8 50%	11 68.75%

Teachers are meeting and discussing differentiated experiences that are not coming to fruition in the classroom. There is a disconnect between what is said in planning and what happens in the classroom with students after teachers leave planning sessions. The amount of time needed to differentiate learning during class was discussed in the focus group as a challenge to implementing differentiated instruction in classes with students of mixed ability levels.

Sub-question 3

Sub-question three asked: "How would teachers in a focus group encourage teachers to use instructional technology to differentiate learning?" The focus group consisted of four teachers and convened via Google Meet®, a digital video conferencing tool similar to Zoom and Microsoft Teams. The group discussed the survey data and answered the focus group interview guide questions that provided clarity on topics related to differentiation using technology (see

Appendix J). After the focus group met, the recording was transcribed and verified by each member of the group. The researcher read through the transcripts the first time without any interruptions. Then, the researcher read through the transcripts again and made notes. The transcripts were then read through with words and phrases pulled out by the researcher and noted in the right margin of the transcript. The transcripts were read two more times to verify that significant words and phrases were chosen, and codes were created from those words and phrases. The following frequency of codes was counted by the researcher (see Table 10).

Table 10

Frequency of Focus Group Codes

Code	Frequency
Resources	15
Needs	9
Differentiation	5
USA Testprep	5
Planning	4
Sharing	3
Searching	3
Nearpod	3
Professional Development	3
Google Tools	2
Time	2
Database	2

Finally, related codes were grouped to form themes. The themes that emerged were resource types, needs, and planning (See Table 11).

Table 11

Focus Group Themes

Resource Types	Needs	Planning
Resources	Professional Development	Differentiation
USA Testprep	Time	Sharing
Nearpod	Database	
Google Tools		
Searching		

Theme #1: Resource types. The first theme to emerge was the types of technology resources used by teachers at XYZ Middle School. The focus group members discussed the available software given to them and how it is used. Ms. Wilkins said, “So, a lot of USA Testprep. Again, every Friday they are assessing in that.” Ms. Adams discussed using Google Tools. “Typically, I will get a Google slide and make some kind of Google slide activity.” Ms. Stone said, “We are using Nearpod this year. They want it embedded in all of our lesson plans.” According to the focus group, using Nearpod and USA Testprep were expectations of the administration, and the data from the survey and focus group showed that teachers were consistently using the digital tools provided. There was also a discussion of searching for instructional technology resources to use. Ms. Stone said, “You may be Googling something, and you find, woah, there is Padlet. So, you try Padlet, and someone else says Pear Deck, so you say good grief. There is just so much out there.” When discussing searching for resources, Ms. Collins spoke of using another school district’s resources. She said, “I used to use that county’s webpage because some of the resources would be available to everybody.” Teachers spoke of the plethora of resources available but did not discuss choosing instructional technology based on which program is best for differentiated lessons. There was a disconnect between using instructional technology and using instructional technology to differentiate learning.

Theme #2: Needs. The second theme to emerge was teacher needs. The focus group discussed different needs throughout the meeting, but most centered on two specific topics. The group discussed the need for time to implement differentiated instruction and the need for more professional development and support in the use of instructional technology. The need for ongoing professional development was also discussed in the leadership interviews and was acknowledged by both the administrator and teachers in leadership positions.

Time. Ms. Adams cited time as a need when discussing differentiated instruction. She said, “Time to make the stuff, time to put it together, time to become creative enough to make it interesting enough for the students.” Ms. Adams went on to suggest a way to create opportunities for differentiated instruction using less of teachers’ time. She said:

I was just going to say that one of the supports I think would help a lot would be to have a database specifically designed so that when new teachers came in, they had access to all of this material.

Ms. Wilkins spoke of needing additional resources that would help teachers plan for differentiation efficiently and meet each students’ needs based on their level of readiness. She said, “Different software and different expectations.” Then she went on to discuss how this would meet the students’ needs when she said, “So, this is math, and these are the standards we are going to cover this year. Well, what about the students who were left behind three years ago?” Ms. Wilkins suggested that planning lessons based on current state standards did not account for students who did not master those in previous years and additional software may help teachers to fill those gaps in learning.

Professional development. The second need addressed was ongoing professional development. Speaking of the integration of Nearpod, Ms. Stone said, “So that was our most

recent professional development, and beyond that everybody would be on their own, I suppose.” During the discussion on instructional technology, Ms. Adams said, “I can say that we have not had any technology developmental improvement things here, but I do a lot on my own of investigating what works well.” In addition, during the discussion, Ms. Wilkins said, “As far as I can tell, they don’t offer a lot of professional development from the programs that we use on a regular basis, and that surprises me.” She followed that up by saying, “Having worked for companies where we come in and do the professional development at schools, I am not seeing that happening in our district.” The need for added and ongoing support in the use of instructional technology teachers are expected to use was evident throughout the discussion.

Theme #3: Planning. The final theme to emerge was inconsistency in how teachers plan. The focus group discussed how each PLC planned together and separately, and it quickly became apparent that there were no set guidelines or expectations other than to meet once a week. Some groups plan together, while others depend on the ideas of one teacher. Ms. Stone said, “Yeah, we meet once a week, and we come up with lots of ideas.” Ms. Collins said, “All of the three science teachers with me are brand new to either the subject, the content, or they are brand new to teaching, or both. So, I am doing all of the planning.” Likewise, planning for differentiated instruction was discussed, and each group did so differently. Ms. Wilkins discussed how the math teams plan differentiated lessons and said, “We definitely do it more as a team, because we definitely have different groups of students.” Ms. Collins said, “I will plan for the week, and they (the other teachers on the team) will differentiate amongst themselves accordingly.” There was a great variance between how different teams created weekly lesson plans and how they planned for differentiated instruction. No group reported planning with the special education teacher or paraprofessional present. Teachers share lesson plans on a shared

drive so that the special education teachers can see them, but they have no voice in planning for students. Ms. Adams, who is teaching a self-contained ELA class said:

I will say that because I am special ed, we don't create lesson plans, and we don't create the unit plans. We don't meet on deciding it. However, when we have information that the teachers create for their lesson plans, we tend to make digital versions of them when we can, just for differentiation.

Just as in the interviews, special education was considered a placement rather than a service.

Discussion

As stated in Chapter Two, differentiation is not a theory of how students learn but is an approach to learning where teachers consider student readiness based upon student-specific data to plan lessons that bring all students to the same destination through different pathways (Tomlinson, 2017). The five criteria for successful implementation of a differentiated approach were identified by Sousa and Tomlinson (2018) as, "... (1) an invitational environment, (2) rich curriculum, (3) assessment to inform teaching and learning, (4) responsive instruction, and (5) leading students and managing routines..." (p. 10). Data collected in this applied study indicated that confusion in defining differentiated instruction among leadership, a lack of guidance for teachers in planning for students with mixed ability levels, and insufficient professional development created challenges for classroom teachers in the successful implementation of differentiated learning using instructional technology.

While using instructional technology to differentiate learning has been widely available since the implementation of one-to-one, it has never been more important than now given the circumstances forced on schools due to the Covid-19 Pandemic. The work completed in this applied study connects foundational theory and data to what is happening in education currently.

The themes identified in the interviews, surveys, and focus group are relevant to the current situation due to Covid-19 and are connected to the theoretical and empirical literature reviewed in Chapter Two.

Theoretical Literature

The theoretical framework for this applied study was rooted in constructivism (Farisi, 2016; Harper & Milman, 2016). As stated in Chapter Two, students who learn through a constructivist approach will work at their own pace, may arrive at different answers to the same question, and are expected to explain the thinking process behind those answers (Sharkins et al., 2017). Data analysis indicated that teachers were not using instructional technology to differentiate learning as often as they were using it to offer differentiated remediation. Differentiated instruction should be used to meet all students at their readiness levels, not simply to remediate students who are not proficient in the current curriculum. Teachers were using one-to-one technology in a whole class fashion, but not differentiating to the extent possible during instruction. The data suggested that teachers were following the guidelines given by the administration to use USA Testprep weekly. Students took a formative assessment through USA Testprep once a week and then were given time to remediate in the areas they were not proficient. USA Testprep was used for remediation only, so students who had mastered the material were not further challenged after testing proficient on any given module. Ms. Wilkins confirmed this when she said, “What we use is USA Test Prep at our school. Students, whether they are high or low, could log in and work on their skills and additional practice areas based on where the need is.” Assessment, in this case, was used to identify areas of students’ needs, but not for extending areas of proficiency. Responsive instruction should be used to inform teaching and learning for all students (Sousa & Tomlinson, 2018). At XYZ Middle School, all students

were assessed, but teachers were not responding to the needs of all students based on the assessment results. Only those who were not proficient were supported. Interviews, survey data, and focus group discussion confirmed that remediation happened more often than extension activities. When using USA Testprep, students were able to work at their own pace as described in constructivism. However, all questions were multiple choice so there were no open-ended questions to guide learning, no variation of correct answers, and no opportunity to explain the process behind how answers were reached.

Vygotsky (1978) said that experience is essential to learning. While there were some indications in the focus group and interviews that teachers tier assignments for students, data analysis showed that the greatest number of teachers use instructional technology as a resource to access the content. Of the teachers surveyed, 93.75% indicated that they used technology for learning new concepts every day, compared to only 31.25% who acknowledged using it daily to differentiate by ability level. Focus group discussions suggested that the reports of daily differentiation were related to the use of USA Testprep for remediation. Ms. Collins said, “I will give them extra time during class, but it is solely up to them to want to do the completion.” To further support this assertion, 31.25% reported daily use of instructional technology for remediation, while only 18.75% reported using instructional technology daily for extension activities. The percentage of teachers who reported differentiating daily matched the percentage of those who reported using instructional technology for remediation. If teachers were using instructional technology to differentiate for all learners, the percentage of daily remediation should have been equal to the percentage of daily use for extension activities.

Tomlinson (2017) pointed out that it is common for teachers to have misconceptions about what constitutes differentiated instruction and stated that differentiated learning is learning

that is prepared for students based upon their current interest, readiness level, or learning profile. While the assessment was reported as an ongoing diagnostic weekly requirement using USA Testprep, the data was solely used to remediate students. The information was not used for teachers in planning future lessons or used to identify students for enrichment activities that would enhance the curriculum. In addition, there were no methods used to create learning profiles for students or incorporate current interests. In her interview, Teacher One alluded to the need for identifying students' likes through software that could collect data on personal interests so those interests could be included in assignments. The data analyzed offered indications of some use of instructional technology for differentiated learning, particularly for remediation; however, using one software program to accommodate all students does not fit the criteria for responsive instruction or rich curriculum, as outlined by Sousa and Tomlinson (2018).

Empirical Literature

Current literature indicated that teachers struggle to effectively plan differentiated lessons because of confusion over what differentiated learning is and is not (Ismajli & Imami-Morina, 2018). A literature review of 28 studies found discrepancies in how differentiated instruction was defined, underscoring the widespread misconceptions associated with differentiated instruction (Bondie et al., 2019). The results of this study conform to the findings of that previous literature analysis. In the interviews, when asked to define differentiation, there were inconsistencies in what was perceived to be differentiated instruction. Administrator One said, "For me personally, it is simply meeting the needs of each of the students." Teacher One said, "Differentiated learning to me you are not only looking at it by choice and you are looking at it by content. You are also looking at it by achievement levels." She went on to explain how she differentiated between her inclusion and gifted classes and how she enjoyed the whole group options of

Nearpod when she said, “I love where you have the front of class lessons. Everybody is at the same place at the same time, but you can pause for them to reflect and move on.” While there was a differentiation between classes, differentiating on the student level was not reported. Teacher Four said, “Theoretically it should be that you are tailoring everything to the student based on their IEPs or whatever you have.” In the interviews, differentiated learning was described as individualized education, whole group work based on class ability level, and services provided to special education students only.

Leadership. Leadership inconsistencies were reflected in teacher confusion in the survey and confirmed in the focus group. Participants of the focus group reported having no guidance on how to implement differentiated instruction using technology. When asked about professional development, Ms. Stone said, “We had the one professional development opportunity when the principal introduced Nearpod... beyond that everybody would be on their own, I suppose.” School leadership impacts all parts of education (Gurr & Drysdale, 2018), so it is not surprising that a lack of guidance at the leadership level has translated to confusion at the teacher level. When asked to define differentiated instruction, Administrator One said, “For me personally, it is simply meeting the needs of each of the students.” In the focus group, when speaking of differentiated instruction, Ms. Stone said, “Yeah, we meet once a week and we come up with lots of ideas.” In both instances, there is confusion regarding differentiation. Differentiated instruction is not individualized learning nor is it a generalized set of activities (Tomlinson, 2017). Teachers are more likely to differentiate when supported by school leadership (Goddard et al., 2019), as seen in the fact that teachers reported USA Testprep as a commonly used differentiation strategy for remediation according to the weekly schedule set forth by the school administration.

Interviews identified inconsistencies in the instructional best practices used by school leadership. There were inconsistencies in models used and expectations communicated regarding the use of instructional technology. When asked the question, *As an instructional leader, how do you encourage teachers to use instructional technology to meet the needs in mixed ability classes?*, there was no evidence of a cohesive philosophy of a shared vision among the school leaders in using instructional technology to differentiate learning or communicating best practices. Administrator One said, “Again, I think one of the most important things is assessing your kids to know where they are.” Teacher One said, “I guess, I am one of those who tries to lead by example, and I model what I expect.” Teacher Three said, “How much differentiation is going on, I honestly do not know.” Teacher Four said, “So my thing is that I only try to bring them in occasionally and ask them how it is going.” Administrator One valued assessment most, Teacher One used modeling, Teacher Three was completely hands-off, and Teacher Four used quick conversations to find out if any assistance was needed. Each school leader articulated his or her leadership role differently. Due to a lack of a shared vision among leadership, teachers are left to their interpretation of how and when to use instructional technology to differentiate learning for students in mixed ability classes.

Planning. Strategic planning of how to integrate instructional technology is paramount to student success (Lee et al., 2017), because instructional technology that is not chosen wisely or implemented correctly can diminish the educational value of what is taught (Higgins et al., 2019). Data collected connected these pitfalls to challenges teachers were facing at XYZ Middle School in planning for and executing differentiated learning using instructional technology. Leaving teachers to their interpretations/preferences on how to conduct planning sessions, including what instructional technology to use and how to best use it, lessened the potential

effectiveness of planning with all stakeholders of the PLC. Each core subject reported different ways of planning for differentiated instruction using technology. The focus group reported that the math team planned together, ELA shared ideas then planned separately, science had one person who planned for the team, and special education teachers were not part of the planning process. The only requirement reported was that subject areas meet once a week for planning. There were no guidelines on what should be accomplished, the expected outcomes of the meetings, or the importance of all members contributing. Current literature has indicated that teachers used differentiated instruction more often when expectations were the same throughout the building (Bogen et al., 2019). Teachers learn from one another and can support one another in the use of differentiated instruction (Gaitas & Martins, 2017; Hargreaves & O'Connor, 2017). Without clear expectations and guidance, the teachers were not capitalizing on the power of planning collaboratively regarding how to differentiate instruction using technology, and were completely missing the valuable input of special education teachers, especially regarding remediation.

Professional Development. Effective professional development improves the quality of education students receive (Kennedy, 2016; Lassig, 2015; Martin et al., 2014) and is positively correlated with effective lesson planning that leads to student achievement (Baez-Hernandez, 2019). In the interviews and the focus group meeting, the need for additional and ongoing professional development was discussed. There were no reported sessions on software teachers were required to use or methods of integrating that software into differentiated lessons. Ms. Wilkins said, “As far as I can tell, they don’t offer a lot of professional development from the programs that we use on a regular basis, and that surprises me.” The professional development teachers reported receiving was single sessions without follow-up support. When asked about

professional development opportunities in the leadership interview, Teacher One said:

As far as for your discipline, the system has done a wonderful job with providing opportunities where you will take a half of a day or maybe even a whole day if it is something new they are trying to implement, and give us the elevator version of what this particular tool can provide and take us through what I call a powder puff course of all the bells and whistles.

A half or whole day is not enough time for teachers to process, learn, and practice new strategies. Empirical data has suggested that ongoing professional development and follow-up support are required if teachers' needs are to be adequately met (Dixon et al., 2014; Valiandes & Neophytou, 2018). Ongoing and follow-up support is described as continual and onsite during the duration of implementation of differentiated instruction (Valiandes & Neophytou, 2018). Conflicting definitions of differentiated instruction and its inconsistent use have been linked to a lack of consistent ongoing professional development (Hussain et al., 2017; Moosa & Shareefa, 2019; Young et al., 2017).

Summary

This chapter included the results and themes identified from interviews, surveys, and a focus group. The details of this chapter described how data was gathered to answer the research questions. In addition, there was an extended discussion on the theoretical framework and empirical literature that support this study.

Data was collected from five interviews with school leadership, 16 core teacher surveys, and a four-member focus group comprised of teachers. The themes that emerged from the interviews were the benefits of one-to-one technology, needs, conflicting viewpoints on differentiated instruction, and special education. The themes that emerged from the survey data

were teachers reported using technology more often for accessing the content, teachers were using the provided software, those who plan more often with their PLC provide extension activities more often, and teachers spend more time planning for differentiated lessons than executing differentiated lessons using technology. The themes that emerged from the focus group were resource types, needs, and planning inconsistencies in how teachers plan for lessons. Chapter Five will present a solution to the problem of encouraging teachers to use instructional technology for differentiated learning.

CHAPTER FIVE: CONCLUSION

Overview

The purpose of this study was to improve the use of instructional technology in differentiated learning for students at XYZ Middle School and to formulate a solution that encouraged teachers to leverage the benefits associated with using one-to-one instructional technology to differentiate. The problem was the insufficient use of one-to-one instructional technology to differentiate learning so that all students in a middle school could receive grade-level assignments that matched their abilities. This chapter will include a restatement of the problem and a proposed solution. The solution will be followed by a detailed description of the resources needed, funds required, roles and responsibilities of those included in the solution, a timeline, and a plan to evaluate the solution.

Restatement of the Problem

XYZ Middle School was a one-to-one schoolwide Title 1 school located in northwestern Georgia that served 947 students grades six through eight. The problem was that instructional technology was not used to its potential in providing differentiated instruction. While the end-of-year test scores had increased since the implementation of one-to-one technology, a large disparity existed between sub-groups. The largest disparity existed between general and special education students. Students who received services as directed by an IEP continued to lag far behind their general education peers in proficiency on state-mandated tests in all of their core classes. This applied study sought to find ways to encourage teachers to use instructional technology to differentiate learning so that all students, regardless of their abilities, could engage in learning at their level of readiness.

Proposed Solution to the Central Question

The central research question was: How can educators improve the use of instructional technology in differentiated learning for students at XYZ Middle School? To propose a solution, the researcher collected both quantitative and qualitative data through interviews, surveys, and a focus group. After careful analysis, themes emerged from each of the data sets, and those themes were triangulated for validity. Data analysis and current literature were used to create a solution to the problem in practice. To improve the use of technology in differentiated learning, leadership will create a common definition of differentiation and set guidelines for professional learning communities (PLCs) in planning for differentiated lessons using instructional technology. To support teachers, a professional development committee will be developed, a database of differentiated lessons will be created, and ongoing sources of professional development that include online access will be provided.

Leadership

The first step to improving the use of instructional technology in differentiated learning is training for school leadership and an opportunity for them to develop a shared vision (Kouzes & Posner, 2017). In the interviews, school leadership shared differing ideas regarding differentiated instruction. There were opposing views of what constitutes differentiated instruction, who should receive differentiated instruction, and different expectations of implementation of and planning for differentiated learning. For this study, school leadership includes all administrators and department chairs. The support of school leadership is positively related to teachers' reports of using differentiated instruction (Goddard et al., 2019). To effectively support teachers in differentiating learning using instructional technology, school leadership must come to a shared, unified vision for differentiated instruction and its implementation.

To start the process, school leadership will form a book club and read *How to Differentiate Instruction in Academically Diverse Classrooms 3rd Edition* (Tomlinson, 2017). They will meet weekly and discuss preassigned chapters. Each week a different member of the club will facilitate the meeting to collectively create a shared vision. Book clubs can be effective sources of professional development while providing flexibility and an opportunity to create a professional learning network (Blanton, Broemmel, & Rigell, 2020; Porath, 2018). After the book has been completed, the leadership team will use two methods from Adaptive Schools to create a common definition of differentiated instruction, as referenced in Tomlinson's book, as well as an expectation for PLC planning. First, the team will complete a Brainstorm Questions activity to identify questions that need to be answered for teachers to adequately plan and employ differentiated learning strategies using instructional technology. In the same meeting during Week 12 of the timeline (see Appendix L), that procedure will be followed by a Carousel Brainstorm activity to answer the questions generated. Information collected in these activities will be used to create a shared definition of what constitutes differentiated instruction, planning guidelines and expectations, and two lesson templates. One template will be for teachers to use for weekly plans, and the other will be used for lessons on the database. Google Docs® will be used to create both templates. School leadership impacts the academic achievement of students and teachers' success in the school (Gurr & Drysdale, 2018), so confusion must be replaced with a clear understanding of how to define, plan for, and implement differentiated instruction.

To further support teachers in using instructional technology for differentiated learning, during Week 12 of the timeline, school leadership will decide how teachers will plan for differentiated learning using instructional technology. They will give guidelines to grade-level PLCs on when to meet, what should be accomplished as a PLC, and how to document that work.

Szeto, Sin, and Leung (2021) found that leadership support can create a needed structure for PLCs to successfully meet the needs of many different students. To leverage all the benefits that accompany teachers working together, teachers must plan together and include special education teachers in those meetings. Currently, special education teachers are not part of the planning process, as indicated by Ms. Adams when she said, “I will say that because I am special ed we don’t create lesson plans, and we don’t create the unit plans. So, we don’t meet on deciding it.” PLCs can be effective in the professional development of teachers because they create an environment that allows teachers to learn differentiated strategies and support one another’s professional growth (Gaitas & Martins, 2017; Hargreaves & O’Connor, 2017). Teachers will work as a unit to support students of all ability levels, and in the process will support one another’s professional growth. In addition, planning together will allow teachers to divide the workload, thereby decreasing the time required to prepare for differentiated learning using instructional technology. Time was cited as a barrier to differentiated instruction in the focus group and is also reflected in the current literature (Aftab, 2015). Clear guidelines for teachers to follow will help teachers to use their required weekly PLC time more efficiently.

Ongoing Supports

Data retrieved through the interviews, focus group, and surveys indicated the need for ongoing professional development with follow-up supports. As stated in Chapter Two, training should be given over time and should include follow-up support if it is to adequately meet the needs of teachers (Dixon et al., 2014; Valiandes & Neophytou, 2018). Supports for teachers will diminish widespread confusion on defining differentiated instruction (Bondie et al., 2019) and will lead to effective lesson planning that supports student achievement (Baez-Hernandez, 2019). To support teachers, a professional development committee will be initiated and a database that

houses differentiated learning using instructional technology lessons plans will be created.

Professional development committee. Currently, XYZ Middle School does not have an instructional coach or professional development committee. To support consistent and ongoing professional development, a committee consisting of at least one teacher from each discipline will be formed. Teachers will apply for a seat on the committee by letting the principal know that they are interested in participating. If more than one teacher from any discipline indicates interest, the administrative team will select which candidate to appoint. This committee will form a book club to read the same book read by the leadership team. Meetings will be facilitated by one or more of the members of the leadership team to ensure that information is interpreted and uniformly applied. After the leadership team has defined differentiated instruction and created guidelines for PLC's weekly planning sessions, the committee will work together to take the principles of differentiated instruction learned from the book, coupled with leadership guidelines, and transfer them to using technology to deliver differentiated lessons. The committee will prepare and deliver sessions throughout the school year on days set aside for synchronous professional development and create asynchronous training modules using technology in which teachers can engage on their own time (Belland et al., 2015; Dede, Eisenkraft, Frumin, & Hartley, 2016). Teachers can choose the asynchronous modules that best suit their needs and support their personal growth in using technology to differentiate instruction. The creation of asynchronous versions of training sessions will ensure that new teachers will receive the same training in upcoming school years. Teachers who are new to the county should complete the asynchronous training modules in the same order that the training was received by other teachers and should complete two modules per nine weeks until they are current. Each module will consist of one hour of in-service learning. Training modules should begin with defining

differentiation, how to plan with the PLC, and how to plan learning that is differentiated per the definition and implementation guidelines developed by the leadership team. Keeping the order initially decided upon will lessen the possibility of creating a cycle of confusion and create a seamless transition into the created model for teachers who are new to the school. The professional development sessions will begin during the training days the first week of school and continue throughout the year. Training sessions that are extended over time and repeated will allow teachers to absorb and apply new learning (Lee et al., 2017). Teachers will receive professional development points for both the synchronous and asynchronous training as an incentive to complete the requirements.

Expanding the professional learning community. Hargreaves and O'Connor (2017) found that collaboration between teachers mostly consists of sharing ideas and is effective for improving best practices, and PLCs can be effective in professional development (Gaitas & Martins, 2017). Teachers will learn together and from one another in the PLCs during weekly planning sessions and will expand the PLC beyond those on the grade level by modeling a lesson that was differentiated to other grade level teachers. At department meetings each month, a different grade level will model a lesson that was differentiated using technology. Those presenting will be expected to model the lesson, share celebrations and challenges associated with the lesson, and field questions from other teachers regarding the lesson. There are three grade levels, so each team will share three times throughout the school year. There is time set aside for training each month during department meetings, so this will add no additional time burden to teachers. Teachers will learn from one another and grow professionally from sharing ideas and having discussions centered on using technology to differentiate instruction (Gaitas & Martins, 2017).

Database. Social media has created new venues for teachers to share content and learn from one another. On their website, Teachers Pay Teachers reported having three million resources made by educators, and current literature has indicated that both pre-service and in-service teachers interact with Pinterest to find ideas for supporting curriculum (Schroeder, Curcio, & Lundgren, 2019). The need to support new teachers in their endeavor to differentiate learning using instructional technology was discussed in both interviews of school leadership and the focus group. Time was also cited in the focus group as a challenge associated with differentiated learning using instructional technology. To meet these needs, a database will be created that allows teachers to share differentiated lessons delivered through instructional technology. The district provides Google Suite® to each teacher, so this database will be created using Google Docs® and will be housed on the district's discipline-specific Google Classroom®. There will be discipline and grade level divisions that are arranged by the state's learning standards so that information is easy to find. To promote professional learning that extends beyond those who teach at XYZ Middle School, the other middle schools in the district will be invited to participate. Including other schools will generate a larger database with more lessons from which teachers can choose and allow teachers to learn from one another new ways to differentiate using instructional technology.

Resources and Funds Needed

Books are the only resource that needs to be purchased. Each member of school leadership and each person serving on the professional development committee will need a copy of *Differentiate Instruction in Academically Diverse Classrooms 3rd Edition* (Tomlinson, 2017). There are three administrators and five department chairs on the school's leadership team. In addition, there are four core disciplines, the special education department, and electives that will

be given representation on the professional development committee. A total of 14 books will be needed to anchor the training for school leadership and the professional development committee.

To cover the cost of the books, funds that are normally allocated for professional development will be used. To purchase 14 books from Amazon, the total cost will be \$308.28. Each book costs \$22.02, and shipping is free. While the books will be used by two book clubs, the books will belong to the school and can be checked out to teachers any time after the initial book club use. The books will be housed in the professional library when not in use. The funds requested could be a potential barrier, as many may question using funds to purchase books rather than on other professional development opportunities. The money requested for all the books is less than the minimum of \$1000.00 it would cost to send one teacher to an Association for Supervision and Curriculum Development (ASCD) conference on differentiated instruction (ASCD, 2021). The nominal fee required to buy the books would help train all stakeholders and create a sustainable medium for supporting teachers in the future.

While it comes at no physical cost, time is also a resource that will be required. Teachers will require time to have synchronous and asynchronous training and ongoing support to put the new learning into practice. Students of teachers who have ongoing professional development show greater academic gains as teachers receive multiple years of professional development (Blanchard et al., 2017). Also, the database will take time to build. Teachers can expect at least one differentiated lesson plan per state standard strand in each discipline by the end of the inaugural school year. As the database develops over the next three years, lessons can be added to support each goal that was not addressed in the first year. The professional development committee will also require time to create synchronous and asynchronous training sessions. After its inaugural year, the committee can add to the collection of training sessions and adjust past

training sessions to improve effectiveness. There are 10 days built into the calendar for teacher work. Five out of the 10 days, teachers can expect at least one synchronous training session that all faculty will attend. In addition to the synchronous session, teachers will complete one asynchronous session to extend and refine learning from the synchronous session on their own time between professional development days. Teachers will be given at least two asynchronous sessions to choose between. To model differentiation, one of the sessions will be for those teachers who feel they are still developing, and one will be for those who feel they are more advanced.

Google Suite® is provided for each teacher, so Google Tools® will be a resource utilized in several different capacities. Google Docs® will be used to create two lesson templates. One template will be used for each teacher's weekly lesson plans and the other template will be used when teachers submit lessons to the shared database. Google Classroom® will be used to give access to the documents to teachers at XYZ Middle School and throughout the district via the shared drive feature. The teachers have access to all the necessary tools without any additional purchases.

Roles and Responsibilities

To implement this solution, XYZ Middle School would need to find staff to fill the roles of ordering books, sitting on the professional development committee, and managing the database. Since the media coordinator is responsible for managing all incoming and outgoing library books, the media coordinator will order the books. After receiving the books, call numbers for them will be created and entered into the system. The books will be checked out to book club participants. When the books are not being used by one of the book clubs, they can be checked out by individual teachers or by the professional development committee to be used

during professional development sessions.

In keeping with the way professional development is usually planned, the principal will convene the leadership book club. The principal will initiate the meetings and act as the point of contact to participants. The book club will meet once a week for five weeks and discuss three chapters at each meeting. At each meeting, to support the development of a shared vision, a different member will facilitate the discussion using the ASCD Study Guide that accompanies the book as talking points. The study guide can be accessed online and is free of charge. After reading the book, the leadership team will meet to establish what constitutes differentiated instruction, develop parameters for planning in the PLC for differentiated learning using instructional technology, a planning template for weekly lesson plans, and a template to standardize lessons submitted on the database. These activities will employ methods found in Adaptive Schools. First, the team will complete a Brainstorm Questions activity to generate ideas of what differentiated learning includes and how planning should be conducted followed by a Carousel Brainstorm activity to clarify the ideas generated. From this information, a clearly articulated statement that defines differentiated instruction will be established. A separate list of planning expectations will be created to guide teachers in their weekly PLC meetings. The information from the statement and list will be used to create a weekly planning document that teachers will use for lesson planning and a template for teachers to submit differentiated lesson plans to the database of shared lessons. Along with other requirements established by the leadership team, the lesson plan templates must include a clearly articulated learning objective and multiple paths to that objective (Tomlinson, 2017). Plans should include learning opportunities for students with low, average, and high levels of understanding of the learning objective and a means of assessing students on their learning. This information will be shared

with teachers at the start of the next school year.

When the book club is meeting, the principal will send an email inviting teachers to apply for a seat on the professional development committee. Formation of the committee should be completed by the time the book club adjourns. The professional development committee will engage in a book club in the same manner as school leadership, and a member of the leadership team will facilitate each meeting. Each person from the leadership team should facilitate at least one professional development committee book club meeting. The same ASCD study guide will be used to facilitate this book club as was used in the last. Upon completion of the book, the committee will select one person who will act as chair. The chair will facilitate all meetings, coordinate all building-level professional development, and act as a liaison between the committee and administration. To ensure adequate communication flow, the chair will become part of the leadership team and will attend all leadership meetings; however, during Week 13 of the timeline, the entire committee will meet with the leadership team to discuss the definition of differentiated instruction and implementation guidelines created in the leadership meeting during Week 12. Each person on the committee will represent their department and will have the responsibility of scheduling the professional development segment each month in their respective department meetings. Monthly professional development will allow teachers in similar content areas to share successful strategies that others may want to use.

Using the information found in two Adaptive Schools brainstorm activities, the leadership team will create a template for sharing lessons on the database and a weekly lesson planning template that will be submitted by individual teachers. Also, teachers can use the lesson planning template along with planning expectations created by the leadership team to guide weekly planning sessions with their PLC. The creation of the lesson plan template and the

database submission template will occur after the chair for the professional development committee has been selected. The timing will ensure consistent communication regarding the information on differentiated learning and planning expectations. Likewise, including all members of leadership will standardize the process and ensure that all necessary components of differentiation using instructional technology are clearly articulated in each lesson. The lesson planning expectation list and template should include that teachers use the understanding by design approach (UbD) (McTighe & Willis, 2019). Understanding by design means teachers will plan units by starting with creating goals that identify what students should be able to do when they finish the unit. From that information, teachers will decide on evidence of learning and plan lessons that enable students to engage in learning. Since the UbD approach is a general expectation at XYZ Middle School, it should be included in the planning list and lesson planning template, and using the UbD approach will allow teachers to effectively plan lessons that are differentiated for students of all ability levels. To aid in the process, the leadership team can access free templates and information online (Tomlinson, McTighe, & Association for Supervision and Curriculum Development, 2006).

Each department chair will solicit a volunteer or team of volunteers from his or her department to set up and maintain a document for differentiated lessons using instructional technology organized according to the grade level state learning standards and content area, and upload that document to Google Classroom® each week after adding new lessons. The database manager will use Google Docs® to create a table that contains each standard and strand associated with that standard by grade level, along with a lesson plan template. Each database manager will be required to create a separate document for each grade level in his or her discipline and ensure submissions are complete. If the submissions are not complete, the lesson

will be returned with a gentle reminder of what needs to be added. The database should house at least one lesson per state-mandated standard by the end of the first year. The database manager will report progress to the leadership team quarterly via email. The leadership team can communicate progress to individual PLCs as information and encouragement to continue adding to the work.

To expand available lessons beyond what is available at XYZ Middle School, teachers from middle schools in the district will be invited to participate through an email sent by the principal. All participants will send their lessons to the database manager at XYZ Middle School assigned to their content area, who will add them to the document. Each discipline has a district Google Classroom® that all teachers can access, so the document will be kept there for all to use.

Timeline

- Order books immediately.
- Week 1: The leadership team will meet for the book club and complete Chapters 1, 2, and 3. Each book club meeting will be guided according to the study guide that accompanies the book.
- Week 2: The leadership team will meet for the book club and complete Chapters 4, 5, and 6.
- Week 3: The leadership team will meet for the book club and complete Chapters 7, 8, and 9.
- Week 4: The leadership team will meet for the book club and complete Chapters 10, 11, and 12.

- Week 5: The leadership team will meet for the book club and complete Chapters 13, 14, and 15. The principal will send an invitation via email for teachers to create a professional development committee.
- Week 6: Administrators will confirm who is serving on the professional development committee and each member of the leadership team will sign up for the meeting to facilitate during the professional development committee's book club.
- Week 7: The professional development committee will meet for the book club and complete Chapters 1, 2, and 3.
- Week 8: The professional development committee will meet for the book club and complete Chapters 4, 5, and 6.
- Week 9: The professional development committee will meet for the book club and complete Chapters 7, 8, and 9.
- Week 10: The professional development committee will meet for the book club and complete Chapters 10, 11, and 12.
- Week 11: The professional development committee will meet for the book club and complete Chapters 13, 14, and 15. This meeting will conclude with a chair selection by the committee. Each department chair should have found a person to serve as the database manager for his or her discipline.
- Week 12: The leadership team with the chair of the professional development committee will meet to develop a shared vision of differentiated learning and create a clearly articulated list of planning expectations using Adaptive Schools brainstorming and carousel activities. The leadership team will design a weekly lesson plan template for

teachers to use for weekly planning and a template for teachers to submit individual lessons to the database.

- Week 13: The leadership team and the professional development committee will meet to ensure a shared vision on decisions made in the leadership meeting on Week 12. The professional development committee will meet to plan training sessions to start the school year that clearly articulate what differentiated instruction is and is not.
- Week 14: The professional development committee will meet to plan training sessions that demonstrate UbD planning and include planning templates and PLC agendas set forth by the administration.
- Week 15: The professional development committee will meet to plan training sessions that instruct teachers on how to use information using UbD to plan differentiated lessons. Each database manager should have created the Google Doc to house all links for differentiated lessons.
- Week 16: The professional development committee will start professional development and continue planning follow-up sessions that support learning from the first three sessions. The principal should email all middle school teachers with an invitation to participate in the database. The email should include the lesson plan template, the names of each discipline data manager, and their email addresses.

The timeline created will allow for professional development on using instructional technology to deliver differentiated learning to begin during the Inservice week of the 2021-2022 school year. To meet this time frame, the books will be ordered immediately and will be logged into the library system using assigned call numbers upon arrival. Week 1 will begin when the leadership team has its first meeting. The goal is to begin the 2020-2021 school year by

establishing what differentiated instruction is and is not, establishing expectations for planning, and creating a firm foundation on how to deliver lessons using instructional technology. At the start of the 2021-2022 school year, the principal will send an email to all middle school teachers inviting them to participate in building the database, along with information on how to submit lessons. The goal for the database is that by the end of the 2020-2021 school year, there will be one lesson plan per state-mandated standard in each subject in each grade level, and will be monitored for adequate progress by the leadership team through quarterly reports. Each following year, teachers will continue to submit lessons on the goals listed under each strand that are not addressed in the inaugural year. While the database is not intended to be a complete curriculum, it will support teachers in implementing differentiated lessons using instructional technology.

Solution Implications

Improving the use of instructional technology to support differentiated instruction will require changes to current procedures, which will impact students, teachers, and administration. Changes to a system can have both positive and negative implications. This section will provide an explanation of the benefits and potential pitfalls of the proposed solution to the problem investigated. Also, there will be a discussion of the positive and negative implications for students, teachers, and administration.

Benefits

Five benefits should result from the proposed solution. First, teachers will receive professional development and ongoing supports that will help them become more efficacious in delivering differentiated lessons using instructional technology (Dixon et al., 2014), which will improve student learning (Awada & Faour, 2018; Fabian et al., 2018; Hoffmann & Ramirez,

2018; Yildirim & Sensoy, 2018). A second benefit is that teachers will experience a reduced workload because of planning together and sharing the task of making lessons. The database with lessons from other middle schools in the county will also aid in reducing the workload of teachers at XYZ Middle School, as well as for teachers at participating schools. Another benefit is that differentiated lessons are planned so that strategies and interventions can be introduced to support students with learning disabilities. This will be a product of including special education teachers in planning sessions. The fourth benefit of this solution is an expanded PLC, as other district schools join in on making a differentiated lessons database. Finally, this quickly implemented and cost-effective solution will provide a sustainable plan that can expand and grow from year to year. This will occur as the professional development committee collects data through quarterly impact checks given to administration by teachers regarding how lessons are being differentiated and the impact on student achievement, and then uses that formative data to develop specific and targeted professional development to support teachers' use of differentiated lessons using instructional technology. Many benefits can happen if this plan is instituted with fidelity.

Pitfalls

There are possible pitfalls that could hinder this plan from developing to its fullest potential. The solution will not work to the fullest potential if not implemented correctly and with fidelity by the administration and teachers. The administration should align the parameters for defining and planning for differentiated learning with the information learned in the book club. Straying from Tomlinson's (2017) work could result in greater confusion about the definition and implementation of differentiated instruction, thereby decreasing the effectiveness of the plan. Administrators should be unified in what is developed and must give clear guidance

based on Tomlinson's model of differentiated instruction. When the plan is given, teachers should follow it with fidelity. If teachers do not plan together and implement differentiated lessons using instructional technology, the impact on student learning will be minimal. The result will be continued confusion, and students of mixed abilities will not be able to engage in the curriculum at their level of readiness. Finally, the professional development committee must take teacher feedback, achievement data, and quarterly impact check data to create and adjust training sessions. The feeling of being valued might come from having a voice through giving feedback on how implementing differentiated lessons using technology is going. If teachers do not feel valued or feel that the training is a waste of time, they will not buy into the initiative, and the solution will not be successful.

Implications

A positive implication for teachers is that they will be able to engage in flexible professional development that will aid them in utilizing instructional technology to deliver differentiated instruction with ongoing support throughout the school year. In addition, they will plan together and reduce their current workload. Planning together will save time, but it will mean changing the way teachers currently plan. A negative implication for some will be that planning together means coming out of their comfort zones and building the trust needed to work closely with a group (Reynolds, 2016). It may be difficult for teachers to implement new practices and engage in the process that accompanies developing new content, processes, and products along with other teachers in their PLC.

Administrators will also be impacted by these changes. A positive implication for administration is that the professional development committee will take the responsibility of planning and providing professional development. The committee will lessen the workload of

administration and ensure new teachers in the following years have access to online training modules from the previous years. A negative implication is that administration will have to give up time to meet for the book club, create the parameters for using instructional technology to deliver differentiated lessons, and facilitate the book club for the professional development committee.

Using instructional technology for differentiated lessons will ensure that students of mixed abilities can engage in the curriculum in a meaningful manner. The positive implication of this is that all students will learn at their appropriate level of readiness and therefore grow academically. Another implication is that learning will become student-centered, and students will take an active role in their learning. For some students, this will be positive by allowing them to participate in the curriculum rather than sitting and listening to what they must go and learn after leaving class. However, for those who require teacher prompting to stay on task, this may be difficult since active learning demands engagement.

Evaluation Plan

To measure the effectiveness of the proposed solution several data points are required. The outcome-based evaluation plan for this study accounts for what teachers believe they are doing, data collected from administration, and the student progress that is the expected result if the plan is effective. Data points collected from teachers should include feedback regarding the professional development, the implementation of planning expectations, the new lesson planning template, and the database. Other data points should include administrative viewpoints of the plan progression and standardized test data. All the data collected should be evaluated individually and then together to create a complete understanding of the impact of the solution. Data gathered should be shared with teachers to keep them informed regarding the effectiveness

of the plan.

Data

During the first training session that will take place after Week 15, the professional development committee will provide three training sessions on the parameters of differentiated learning using instructional technology to provide a common definition for differentiated instruction, expectations for planning with the PLC, and a framework for how to provide differentiated learning using instructional technology, respectively. After these three training sessions have occurred and misconceptions have been resolved, the committee will administer the survey from this study. At the end of the year, teachers should take the same survey again. After a year of professional development sessions and access to a database of lessons, the end-of-year results should reflect an increase in how often technology was used and the percentage of teachers using instructional technology to differentiate learning for all groups of students.

Every quarter, teachers are required to meet with the administrators and present specific data in what is called an Impact Check. The data includes demographic information regarding students and their grades, along with specific interventions that have and will be implemented to ensure the success of each student. The data is put into a Google® Slideshow using a template provided by the administration and housed on a shared drive so that all teachers can view one another's plan. The professional development committee should collect data from the differentiated portion of the report at the end of each quarter to measure how much and how often their professional development is implemented. The data includes a breakdown of each letter grade and the number of each subgroup who received that grade. There is a slide dedicated to differentiated strategies that have been employed and a slide for new differentiated strategies that will be added. This quarterly data point check can act as a formative assessment that allows

for adjustments to upcoming professional development sessions. The professional development committee can directly measure the strategies used and grades of those students who have been exposed to specific strategies. That data can then be used to target and plan for the most effective aspects of differentiated instruction.

The last data point that is reflective of this plan's effectiveness is student growth. In addition to Georgia milestones, students at XYZ Middle School take a reading, math, science, and social studies test at the start of the year and the end of the year to measure growth per class for the school year. Students of teachers who use a differentiated approach using instructional technology will be able to engage in the curriculum at their level of readiness and should show academic gains as a result (Awada & Faour, 2018; Fabian et al., 2018; Hoffmann & Ramirez, 2018; Yildirim & Sensoy, 2018). The professional development committee can use student growth as a data point in evaluating this solution. Student growth reflected in the quarterly impact check can be compared to the student's specific teacher's use of differentiated strategies to measure the effectiveness of the strategies used. XYZ Middle School state-mandated test scores have shown a large disparity between special education students and their peers. The data collected on student growth and teacher use of differentiated learning through instructional technology can be directly linked to students with disabilities to measure the effectiveness of the strategies that were employed.

Once the professional development committee collects data from teachers, administrative reports, and student achievement, they can evaluate the effectiveness of the solution. If the solution is effective, there will be an increase in the use of instructional technology to differentiate learning reflected in the teacher survey, the quarterly administrative reports will reflect differentiated strategies learned through the professional development committee, and

students' academic growth will increase for the year. The committee can identify specific areas for improvement if all three checkpoints do not show improvement. Likewise, the committee can use the collected data to make necessary adjustments for the next school year. For example, if teachers are implementing strategies but all subgroups are not showing growth, there can be additional sessions provided the following year on reaching the subgroup that did not demonstrate academic growth.

Delimitations

The need for implementing a differentiated approach to learning using instructional technology prevails throughout K-12 education. This study was delimited by choosing a small portion of K-12 learning on which to focus. This study was focused on the middle school years and the specific needs represented by teachers and students learning in a one-to-one environment.

Limitations

This study had some limitations. The first limitation is that the data collected only represents those who participated. The survey, interviews, and focus group did not have the level of participation planned in the original proposal. While 36 teachers were invited to participate in the survey, only 16 opted to respond. Having the input of a larger number of teachers would have produced more robust survey data. Also, the researcher wanted to interview two administrators, but only one was willing to participate. Input from additional administrators would have provided a collective view of administrative support. Finally, the focus group was planned for six members, but only four attended the online meeting, limiting the scope of information received from the meeting.

A second limitation to this study was that all data was self-reported. The survey, the

interviews, and the focus group utilized self-reported measures. All data retrieved was based on what the person answering the questions believed to be true rather than actual measurements taken on implementing a differentiated approach using instructional technology in real-time. Future studies could collect data on the implementation of a differentiated approach in different ways, such as a checklist that provides an opportunity for teachers to respond with a tick mark each time a specific task is completed or through researcher observations. This would reduce ambiguity and give a more accurate record of how instruction is being differentiated. Another limitation is that self-reported answers could be given out of fear of peer judgment if a respondent perceives a “right answer” to a particular question (Bickman & Rog, 2009).

Future Research

This study sought to find ways to encourage teachers to use instructional technology to deliver differentiated lessons to students of mixed abilities. Moving forward, there are a couple of recommendations for future studies.

A study could be conducted that investigates how teachers use instructional technology to differentiate learning to define and illustrate what differentiated instruction looks like in practice. Such a study could compare the instruction delivered to the SAMR model and find how many teachers are using technology at the higher levels of modification and redefinition when using a differentiated approach. Most teachers tend to use the lower levels of substitution and augmentation (Chou & Block, 2019; Crompton et al., 2019). While training teachers in both differentiation and using higher levels of SAMR could be challenging for teachers, it would give a greater purpose to the way technology is utilized in differentiated lessons and may be more engaging to students. Applying the higher levels of SAMR in delivering differentiated instruction will result in using instructional technology to its fullest potential while supporting

higher-level thinking and academic growth.

Another possibility centers on early training in using a differentiated approach. Teacher preparatory programs do not provide enough training to effectively implement a differentiated approach to learning (Chesley & Jordan, 2012), and teacher efficacy in using a differentiated approach is positively correlated to professional development in implementing differentiated instruction (Baez-Hernandez, 2019; Cirusuolo, 2019; Schipper et al., 2018; Suprayogi et al., 2017). Another recommendation is a case study of a district that provides instruction on differentiated methods using instructional technology as part of the requirements for teachers new to the district. Teachers may be more likely to use a differentiated approach with an implemented program that begins at the start of their careers.

Summary

Growing diversity coupled with the Covid-19 Pandemic has created a greater urgency in the need to use instructional technology to meet the needs of students with different levels of readiness than has ever been experienced. This study investigated how to improve the insufficient use of one-to-one instructional technology to differentiate learning so that all students in a middle school could receive standards-based instruction at their readiness levels. Interviews with school leadership, teacher surveys, and focus group data were used to form a solution to the ongoing problem in education today.

The solution discussed in this chapter emphasized the importance of administrative support and creating a building-wide plan to implement differentiated learning using instructional technology. The building-wide plan started with the leadership team constructing a shared vision by defining differentiated instruction and creating a professional development committee that could support teachers through ongoing professional development. Also, the

solution included the importance of teachers working and planning together so that they all benefit from one another's experience and can grow professionally. Just as students do not arrive at school as "matched sets" (Tomlinson, 2017), neither do teachers. This plan included differentiated and ongoing supports to aid teachers in improving the use of instructional technology in differentiated learning. Using this plan will improve teachers' abilities to use instructional technology to differentiate learning and help them with creating lessons that match their students' levels of readiness. One-to-one technology has unlimited potential to redefine how students learn and should be used to meet the needs of all students regardless of their abilities.

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APPENDIX A: IRB Approval

LIBERTY UNIVERSITY INSTITUTIONAL REVIEW BOARD

November 2, 2020

Cecelia Baggott
Brian Jones

Re: IRB Exemption - IRB-FY20-21-190 Technology Use for Differentiated of Instruction in Middle School: An Applied Research Study

Dear Cecelia Baggott, Brian Jones:

The Liberty University Institutional Review Board (IRB) has reviewed your application in accordance with the Office for Human Research Protections (OHRP) and Food and Drug Administration (FDA) regulations and finds your study to be exempt from further IRB review. This means you may begin your research with the data safeguarding methods mentioned in your approved application, and no further IRB oversight is required.

Your study falls under the following exemption category, which identifies specific situations in which human participants research is exempt from the policy set forth in 45 CFR 46: 101(b):

Category 2.(iii). Research that only includes interactions involving educational tests (cognitive, diagnostic, aptitude, achievement), survey procedures, interview procedures, or observation of public behavior (including visual or auditory recording) if at least one of the following criteria is met:


The information obtained is recorded by the investigator in such a manner that the identity of the human subjects can readily be ascertained, directly or through identifiers linked to the subjects, and an IRB conducts a limited IRB review to make the determination required by §46.111(a)(7).

Your stamped consent form can be found under the Attachments tab within the Submission Details section of your study on Cayuse IRB. This form should be copied and used to gain the consent of your research participants. If you plan to provide your consent information electronically, the contents of the attached consent document should be made available without alteration.

Please note that this exemption only applies to your current research application, and any modifications to your protocol must be reported to the Liberty University IRB for verification of continued exemption status. You may report these changes by completing a modification submission through your Cayuse IRB account.

If you have any questions about this exemption or need assistance in determining whether possible modifications to your protocol would change your exemption status, please email us at irb@liberty.edu.

Sincerely,


Administrative Chair of Institutional Research
Research Ethics Office

APPENDIX B: District Consent

October 6, 2020

Ms. Baggott,

Your *Research Application* to collect data at the [REDACTED] County School System was reviewed and approved on 10/6/2020 on the condition of data not being collected during teacher work time.

Best of luck to you in completing your study, *Technology Use for Differentiation of Instruction in Middle School: An Applied Research Study*.

Sincerely,

A black rectangular redaction box covering a handwritten signature.

[REDACTED] PsyD
Lead School Psychologist
504 Coordinator

APPENDIX C: Interview Recruitment Email

Dear [Recipient]:

As a graduate student in the School of Education at Liberty University, I am conducting research as part of the requirements for a doctoral degree. The purpose of this study is to identify challenges teachers face with using instructional technology to differentiate learning for students and to formulate a solution that encourages teachers to leverage the benefits associated with using technology to differentiate. I am writing to invite eligible participants to join my study.

Participants must be 18 years of age or older and in a position of leadership in a middle school. Participants, if willing, will be asked to participate in an interview using Google Meet® and verify the transcripts of the meeting as a means of member checking for accuracy. It should take approximately 30 to 45 minutes to complete the interview, and 15 minutes to verify the transcripts. Participant names and other personal information may be requested as part of this study, but all data shall remain confidential.

In order to participate, please respond to this email to schedule an interview time.

A consent document is attached to this email. You will be asked to read, sign, and return the consent document to me prior to the interview. The consent document contains additional information about my research.

Sincerely,

Cecelia Baggott
Ed.D Candidate Liberty University



APPENDIX D: Survey Recruitment Email

Dear [Grade Level] Teachers:

As a graduate student in the School of Education at Liberty University, I am conducting research as part of the requirements for a doctoral degree. Last week an email was sent to you inviting you to participate in a research study. This follow-up email is being sent to remind you to use the link provided below to participate if you have not already done so. The deadline for participation is November 18.

If you choose to participate you will be asked to participate in a survey. It should take approximately 10 minutes to complete the procedures listed. Participation will be completely anonymous, and no personal, identifying information will be collected.

A consent document is attached to this email and is also provided as the first page of the survey. The consent document contains additional information about my research. After reading the consent document, please proceed to the survey. If you decide to participate, click here [Link].

Sincerely,

Cecelia Baggott
Ed.D Candidate Liberty University

[Redacted Signature]

APPENDIX E: Focus Group Recruitment Email

Dear Teachers:

As a graduate student in the School of Education at Liberty University, I am conducting research as part of the requirements for a doctoral degree. The purpose of this study is to identify challenges teachers face with using instructional technology to differentiate learning for students and to formulate a solution that encourages teachers to leverage the benefits associated with using technology to differentiate. I am writing to invite eligible participants to join my study.

Participants must be 18 years of age or older and have been a teacher in the middle school for the past three years. Participants, if willing, will be asked to participate in a focus group using Google Meet® and verify the transcripts of the meeting as a means of member checking for accuracy. It should take approximately 45 to 60 minutes to participate in the focus group and 25 to 30 minutes to verify the transcripts. Participant names and other personal information may be requested as part of this study, but all data shall remain confidential.

In order to participate, please respond to this email to express your interest. If you are selected, I will send follow-up information regarding the focus group.

A consent document is attached to this email. You will be asked to read, sign, and return the consent document to me prior to the focus group. The consent document contains additional information about my research.

Sincerely,

Cecelia Baggott
Ed.D. Candidate Liberty University



APPENDIX F: Interview Consent Form

Interview Consent Form

Improving Technology Use in Differentiation Through Applied Research
Cecelia Baggott
Liberty University
School of Education

You are invited to participate in a research study. You were selected as a possible participant in this study because you meet the following criteria:

- You are 18 years of age or older.
- You are a member of leadership at the school studied.

Taking part in this research project is voluntary. Please take time to read this entire form and ask questions before deciding whether to take part in this research project. The person conducting this study is Cecelia Baggott, a doctoral candidate at the School of Education at Liberty University.

Background Information: The purpose of this study is to identify challenges teachers face with using instructional technology to differentiate learning for students. From the data collected a plan will be drafted that supports teachers in the use of instructional technology to differentiate learning.

Procedures: If you agree to participate in this study, you will be asked to do the following:

1. Take part in an interview. The interview will take place on Google Meet® and take between 30 to 45 minutes to complete and will be recorded.
2. Review the transcripts from the interview to correct any mistakes made in the transcripts. This activity will take approximately 15 minutes to complete.

Benefits: Participants should not expect to receive a direct benefit from taking part in this study. However, a benefit to society is a better understanding of how to employ instructional technology to help improve the academic achievement of students of all ability levels.

Risks: The risks involved in this study are minimal, which means they are equal to the risks you would encounter in everyday life.

Confidentiality: The record of this study will be kept private. Published reports will not include any information that will make it possible to identify a subject. Research records will be stored securely, and only the researcher will have access to the records.

- Participants responses will be anonymous.
- Data will be stored on a password-locked computer and may be used in future presentations. After three years, all electronic records will be deleted.
- The interview will be recorded and transcribed. Recordings will be stored on a password locked computer for three years and then erased. Only the researcher will have access to these recordings.

Compensation: Participants will not be compensated for participating in this study.

Participation: Participation in this study is voluntary. Your decision whether to participate will not affect your current or future relations with Liberty University. If you decide to participate, you are free to not answer any question or withdraw at any time without affecting those relationships.

How to withdraw from the study: If you choose to withdraw from the study, please contact the researcher at the email address/phone number included in the next paragraph. Should you choose to withdraw, data collected from you, apart from the focus group, will be destroyed immediately and will not be included in this study.

Contact Information: The researcher conducting this study is Cecelia Baggott. You may ask any questions you have now. If you have questions later, **you are encouraged** to contact me at [REDACTED] or email me at [REDACTED]. You may also contact the researcher's faculty sponsor, Dr. Brian Jones at [REDACTED].

If you have any questions or concerns regarding this study and would like to talk to someone other than the researcher, **you are encouraged** to contact the Institutional Review Board, 1971 University Blvd., Green Hall Ste. 2845, Lynchburg, VA 24515 or email at irb@liberty.edu.

Consent: By signing this document, you are agreeing to be in this study. Make sure you understand what the study is about before you sign. You will be given a copy of this document for your records. The researcher will keep a copy with the study records. If you have any questions about the study after you sign this document, you can contact the study team using the information provided above.

I have read and understood the above information. I have asked questions and have received answers. I consent to participate in the study.

☐ The researcher has my permission to audio-record me as part of my participation in this study.

Printed Subject Name

Signature & Date

APPENDIX G: Survey Consent Form

Survey Consent Form

Technology Use for Differentiation of Instruction in Middle School: An Applied Research Study

Cecelia Baggott
Liberty University
School of Education

You are invited to participate in a research study. You were selected as a possible participant in this study because you meet the following criteria:

- You are 18 years of age or older.
- You are a full-time teacher of a core subject at the middle school studied.

Taking part in this research project is voluntary. Please take time to read this entire form and ask questions before deciding whether to take part in this research project. The person conducting this study is Cecelia Baggott, a doctoral candidate at the School of Education at Liberty University.

Background Information: The purpose of this study is to identify challenges teachers face with using instructional technology to differentiate learning for students and to formulate a solution that encourages teachers to leverage the benefits associated with using technology to differentiate. From the data collected a plan will be drafted that supports teachers in the use of instructional technology to differentiate learning.

Procedures: If you agree to participate in this study, you will be asked to do the following:

1. Take part in an anonymous online survey (10 minutes).

Benefits: Participants should not expect to receive a direct benefit from taking part in this study. However, a benefit to society is a better understanding of how to employ instructional technology to help improve the academic achievement of students of all ability levels.

Risks: The risks involved in this study are minimal, which means they are equal to the risks you would encounter in everyday life.

Confidentiality: The record of this study will be kept private. Research records will be stored securely, and only the researcher will have access to the records.

- Participants responses will be anonymous.
- Data will be stored on a password-locked computer and may be used in future presentations. After three years, all electronic records will be deleted.

Compensation: Participants will not be compensated for participating in this study.

Voluntary Participation: Participation in this study is voluntary. Your decision whether to participate will not affect your current or future relations with Liberty University or your school district. If you decide to participate, you are free to not answer any question or withdraw at any time, prior to submitting the survey, without affecting those relationships.

How to withdraw from the study: If you choose to withdraw from the study, please exit the survey and close your browser. Your responses will not be included in the study.

Contact Information: The researcher conducting this study is Cecelia Baggott. You may ask any questions you have now. If you have questions later, **you are encouraged** to contact me at

██████████ or email me at ██████████. You may also contact the researcher's faculty sponsor, Dr. Brian Jones at ██████████.

If you have any questions or concerns regarding this study and would like to talk to someone other than the researcher, **you are encouraged** to contact the Institutional Review Board, 1971 University Blvd., Green Hall Ste. 2845, Lynchburg, VA 24515 or email at irb@liberty.edu.

Consent: If you have any questions about the study, you can contact the research team using the information provided above. Please click on the following survey link to indicate that you have read and understand the above consent information and would like to take part in the survey. [Survey Link].

APPENDIX H: Focus Group Consent Form

Focus Group Consent Form

Technology Use for Differentiation of Instruction in Middle School: An Applied Research Study

Cecelia Baggott
Liberty University
School of Education

You are invited to participate in a research study. You were selected as a possible participant in this study because you meet the following criteria:

- You are 18 years of age or older.
- You are a full-time teacher at the middle school studied.
- You have been at the school studied for at least three years.

Taking part in this research project is voluntary. Please take time to read this entire form and ask questions before deciding whether to take part in this research project. The person conducting this study is Cecelia Baggott, a doctoral candidate at the School of Education at Liberty University.

Background Information: The purpose of this study is to identify challenges teachers face with using instructional technology to differentiate learning for students and to formulate a solution that encourages teachers to leverage the benefits associated with using technology to differentiate. From the data collected a plan will be drafted that supports teachers in the use of instructional technology to differentiate learning.

Procedures: If you agree to participate in this study, you will be asked to do the following:

1. Take part in a six person focus group that consists of teachers from this school. The focus group will convene on Google Meet[®] and take between 45 to 60 minutes to complete and will be audio recorded.
2. Review the transcripts from the group meeting to correct any mistakes made in the transcripts. This activity will take approximately 25 to 30 minutes to complete.

Benefits: Participants should not expect to receive a direct benefit from taking part in this study. However, a benefit to society is a better understanding of how to employ instructional technology to help improve the academic achievement of students of all ability levels.

Risks: The risks involved in this study are minimal, which means they are equal to the risks you would encounter in everyday life.

Confidentiality: The records of this study will be kept private. Published reports will not include any information that will make it possible to identify a subject. Research records will be stored securely, and only the researcher will have access to the records.

- Participant responses will be kept confidential through the use of pseudonyms and codes.
- The focus group session will be conducted on Google Meet[®] so only the teachers in the focus group will hear what is said.
- Data will be stored on a password-locked computer and may be used in future presentations. After three years, all electronic records will be deleted.

- The focus group meeting will be recorded and transcribed. Recordings will be stored on a password locked computer for three years and then erased. Only the researcher will have access to these recordings.
- While discouraged, other teachers of the focus group may share what was discussed with persons outside of the group.

Compensation: Participants will not be compensated for participating in this study.

Participation: Participation in this study is voluntary. Your decision whether to participate will not affect your current or future relations with Liberty University or your school district. If you decide to participate, you are free to not answer any question or withdraw at any time without affecting those relationships.

How to withdraw from the study: If you choose to withdraw from the study, please contact the researcher at the email address/phone number included in the next paragraph. Should you choose to withdraw, data collected from you, apart from the focus group, will be destroyed immediately and will not be included in this study. Focus group data will not be destroyed, but your contributions to the focus group will not be included in the study if you choose to withdraw.

Contact Information: The researcher conducting this study is Cecelia Baggott. You may ask any questions you have now. If you have questions later, **you are encouraged** to contact me at [REDACTED] or email me at [REDACTED]. You may also contact the researcher's faculty sponsor, Dr. Brian Jones at [REDACTED].

If you have any questions or concerns regarding this study and would like to talk to someone other than the researcher, **you are encouraged** to contact the Institutional Review Board, 1971 University Blvd., Green Hall Ste. 2845, Lynchburg, VA 24515 or email at irb@liberty.edu.

Consent: By signing this document, you are agreeing to be in this study. Make sure you understand what the study is about before you sign. You will be given a copy of this document for your records. The researcher will keep a copy with the study records. If you have any questions about the study after you sign this document, you can contact the study team using the information provided above.

I have read and understood the above information. I have asked questions and have received answers. I consent to participate in the study.

The researcher has my permission to audio-record me as part of my participation in this study.

Printed Subject Name

Signature & Date

APPENDIX I: Interview Protocol

Interview Protocol

Interview 1,2,3,4,5

Date _____

Time started _____ Time Ended _____

Script: Thank you for taking your time today to help me in this study. As previously explained, this is an applied study that seeks to find ways to increase the amount of differentiated instruction students receive using technology. To facilitate the process of conducting this interview I am recording our conversation. I will be the only one to hear the conversation, and your identity will be held in the strictest confidence. This interview is completely on a voluntary basis, and if for any reason you feel uncomfortable, do not wish to answer a question, or want to stop the interview at any time during this session, let me know. I assure you that I respect your feelings and will continue to do so throughout the interview. This process will take about 30 to 45 minutes to complete. Do you have any questions for me before we start?

Demographic Questions:

- A. How long have you been in education?
- B. What is your highest degree?
- C. What is your field of study?

Interview Questions:

1. From your observations, how has one to one technology changed school-wide instructional practices?
2. How does the one to one initiative support the mission and vision of the school?
3. What safeguards are in place to ensure equity for all students when teachers use instructional technology in the classroom or in homework assignments?
4. What does differentiated instruction mean to you?
5. Give specific examples of how you have observed differentiated learning supported by instructional technology in the school?
6. As an instructional leader how do you encourage teachers to use instructional technology to meet the needs in mixed ability classes?
7. How are teachers trained through the school and district to use instructional technology to differentiate instruction?

8. What are some ways you model the use of instructional technology to differentiate learning expectations to the faculty?
9. How do you assess technology needs among teachers?
10. What is your vision of how instructional technology can be used school-wide to meet the needs presented by the growing diversity in the school?
11. Due to Covid-19 schools have been forced to rely more on technology for instruction. What opportunities has this provided for your school? Follow up with: What new challenges has your school faced?

Pre-planned probes include the following:

1. Tell me more about...
2. Give me an example of...
3. For clarification please explain...
4. Why do you say...?
5. How could...?

Focus Group Consent Form

Improving Technology Use in Differentiation Through Applied Research
Cecelia Baggott
Liberty University
School of Education

You are invited to participate in a research study. You were selected as a possible participant in this study because you meet the following criteria:

- You are 18 years of age or older.
- You are a full-time teacher at the school studied.
- You have been at the school studied for at least three years.

Taking part in this research project is voluntary. Please take time to read this entire form and ask questions before deciding whether to take part in this research project. The person conducting this study is Cecelia Baggott, a doctoral candidate at the School of Education at Liberty University.

Background Information: The purpose of this study is to identify challenges teachers face with using instructional technology to differentiate learning for students. From the data collected a plan will be drafted that supports teachers in the use of instructional technology to differentiate learning.

Procedures: If you agree to participate in this study, you will be asked to do the following:

1. Take part in a six person focus group that consists of teachers from this school. The focus group will convene on Google Meet and take between 45 to 60 minutes to complete and will be recorded.
2. Review the transcripts from the group meeting to correct any mistakes made in the transcripts. This activity will take approximately 25 to 30 minutes to complete.

Benefits: Participants should not expect to receive a direct benefit from taking part in this study. However, a benefit to society is a better understanding of how to employ instructional technology to help improve the academic achievement of students of all ability levels.

Risks: The risks involved in this study are minimal, which means they are equal to the risks you would encounter in everyday life.

Confidentiality: The record of this study will be kept private. Published reports will not include any information that will make it possible to identify a subject. Research records will be stored securely, and only the researcher will have access to the records.

- Participants responses will be anonymous.
- The focus group session will be conducted on Google Meet so only the teachers in the focus group will hear what is said.
- Data will be stored on a password-locked computer and may be used in future presentations. After three years, all electronic records will be deleted.

- The focus group meeting will be recorded and transcribed. Recordings will be stored on a password locked computer for three years and then erased. Only the researcher will have access to these recordings.
- While discouraged, other teachers of the focus group may share what was discussed with persons outside of the group.

Compensation: Participants will not be compensated for participating in this study.

Participation: Participation in this study is voluntary. Your decision whether to participate will not affect your current or future relations with Liberty University. If you decide to participate, you are free to not answer any question or withdraw at any time without affecting those relationships.

How to withdraw from the study: If you choose to withdraw from the study, please contact the researcher at the email address/phone number included in the next paragraph. Should you choose to withdraw, data collected from you, apart from the focus group, will be destroyed immediately and will not be included in this study.

Contact Information: The researcher conducting this study is Cecelia Baggott. You may ask any questions you have now. If you have questions later, **you are encouraged** to contact me at [REDACTED] or email me at [REDACTED]. You may also contact the researcher's faculty sponsor, Dr. Brian Jones at [REDACTED].

If you have any questions or concerns regarding this study and would like to talk to someone other than the researcher, **you are encouraged** to contact the Institutional Review Board, 1971 University Blvd., Green Hall Ste. 2845, Lynchburg, VA 24515 or email at irb@liberty.edu.

Consent: By signing this document, you are agreeing to be in this study. Make sure you understand what the study is about before you sign. You will be given a copy of this document for your records. The researcher will keep a copy with the study records. If you have any questions about the study after you sign this document, you can contact the study team using the information provided above.

I have read and understood the above information. I have asked questions and have received answers. I consent to participate in the study.

☐ The researcher has my permission to video-record me as part of my participation in this study.

Printed Subject Name

Signature & Date

APPENDIX J: Focus Group Guide

Focus Group Interview Guide

Number of participants _____

Start time _____ Time ended _____

Script: Thank you for taking your time today to help me in this study with your participation in this focus group. As previously explained, this is an applied study that seeks to find ways to increase the amount of differentiated instruction students receive using technology. To facilitate the process of conducting this focus group, I am recording our conversation. I will be the only one to hear the conversation, and your identity will be held in the strictest confidence. This interview is completely on a voluntary basis, and if for any reason you feel uncomfortable, do not wish to answer a question, or want to drop out of the focus group at any time during this session, let me know. I assure you that I respect your feelings and will continue to do so throughout the entire process. There are a few ground rules we need to follow so that everyone has the opportunity to share.

- There are no wrong answers in this forum, so please feel free to share. All input is valuable.
- Only one person should talk at a time. Please allow the speaker to share completely before giving input.
- I am the moderator, so I will move us from question to question.

I have prepared 10 questions to guide your discussion, but it may not be necessary to ask each one. Does anyone have any questions before we begin?

1. After reviewing the data shared with you on the survey taken, are there any trends that you noticed?
2. Do students in your core area use instructional technology for learning, and if so how?
3. Do students in your core area use technology to show learning, and if so how?
4. How has the implementation of the one-to-one initiative changed the way your team provides instruction to students?
5. How do teachers in your subject area decide how and when to integrate instructional technology into unit lesson plans?

6. How does your team use instructional technology to reach students with mixed abilities in classrooms so that all the students can engage in learning? When filling in the ways your team will differentiate instruction in your lesson plans, give a few examples of the information your team puts into the plan.
7. What are some barriers that hinder the ability to differentiate learning using instructional technology for students in your teams' classrooms?
8. Has the implementation of one-to-one changed your role in the classroom and if so how?
9. What kind of professional development and follow up supports have you received in the past three years that directs how you use instructional technology to differentiate learning in the classroom? This question will be followed up with: What kind of professional development has been most effective?
10. What supports are needed for teachers to increase the current use of technology in differentiated learning?

APPENDIX K: Survey Questions

Survey Questions

General Demographic Questions

A. How long have you been in education?

B. What is your level of education?

Answer the following questions and click submit at the end.

1. I use Google Classroom to make assignments for students to access in class.

Daily	Weekly	Monthly	Never
1	2	3	4

2. Students use their Chromebooks in class for learning new concepts.

Daily	Weekly	Monthly	Never
1	2	3	4

3. I use instructional technology to differentiate lessons for students by varying assignments based on ability level.

Daily	Weekly	Monthly	Never
1	2	3	4

4. I use instructional technology to give students choices on how to express their learning.

Daily	Weekly	Monthly	Never
1	2	3	4

5. I discuss and plan for accommodating students at all readiness levels using instructional technology with one or more members of my PLC.

Daily	Weekly	Monthly	Never
1	2	3	4

6. I plan technology-supported lessons that accommodate a combination of students' audio, visual, tactile, and kinesthetic learning preferences.

Daily	Weekly	Monthly	Never
1	2	3	4

7. I use instructional technology to administer formative assessments that guide lesson planning.

Daily	Weekly	Monthly	Never
1	2	3	4

8. Using instructional technology to differentiate learning allows me to take the role of facilitator and provide support to individual students as I see the need.

Daily 1	Weekly 2	Monthly 3	Never 4
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9. I use instructional technology to provide remediation or interventions for students who have deficits in the content we are learning in class.

Daily 1	Weekly 2	Monthly 3	Never 4
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10. I use instructional technology to provide extension activities for students who have already mastered material we are learning in class.

Daily 1	Weekly 2	Monthly 3	Never 4
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APPENDIX L: Timeline

Timeline

- Order books immediately
- Week 1: Leadership team will meet for the book club and complete Chapters 1, 2, and 3. Each book club meeting will be guided by the study guide that accompanies the book.
- Week 2: Leadership team will meet for the book club and complete Chapters 4, 5, and 6.
- Week 3: Leadership team will meet for the book club and complete Chapters 7, 8, and 9.
- Week 4: Leadership team will meet for the book club and complete Chapters 10, 11, and 12.
- Week 5: Leadership team will meet for the book club and complete Chapters 13, 14, and 15. The principal will send an invitation via email for teachers to create professional development committee.
- Week 6: Administrators will confirm who is serving on the professional development committee and each member of the leadership team will sign up for the meeting to facilitate during the professional development committee's book club.
- Week 7: The professional development committee will meet for the book club and complete Chapters 1, 2, and 3.
- Week 8: The professional development committee will meet for the book club and complete Chapters 4, 5, and 6.
- Week 9: The professional development committee will meet for the book club and complete Chapters 7, 8, and 9.
- Week 10: The professional development committee will meet for the book club and complete Chapters 10, 11, and 12.
- Week 11: The professional development committee will meet for the book club and complete Chapters 13, 14, and 15. This meeting will conclude with a chair selection by the committee. Each department chair should have found a person to serve as the database manager for their discipline.
- Week 12: The leadership team, including the newly added chair from the professional development committee, will meet to develop a shared vision of differentiated learning and create a clearly articulated list of planning expectations using Adaptive Schools brainstorming and carousel activities. The team will design a weekly lesson plan template for teachers to use for weekly planning and a template for teachers to submit individual lessons to the database.
- Week 13: The leadership team and the professional development committee will meet to ensure a shared vision on decisions made in the leadership meeting on week 12. The professional development committee will meet to plan training sessions to start the school year that clearly articulate what differentiated instruction is and is not.
- Week 14: The professional development committee will meet to plan training sessions that demonstrate UbD planning and includes planning templates and PLC agendas set forth by administration.

- Week 15: The professional development committee will meet to plan training sessions that instructs teachers how to use information using UbD to plan differentiated lessons. Each database manager should have created the Google Doc to house all links for differentiated lessons.
- Week 16: The professional development committee will start professional development and continue to plan follow up sessions that support learning from the first three sessions. The principal should email all middle school teachers with an invitation to participate in the database. The email should include the lesson plan template, the names of each discipline data manager, and their email addresses.