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Perceptions, Potholes, and Possibilities of Using Digital Voice Assistants to Differentiate Instructions

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This is to certify that the doctoral study by

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Walden University
2020

Abstract

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MS, Walden University, 2017

BBA, Monroe College, 2016

Dissertation Submitted in Partial Fulfillment

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Abstract

Access to technologies and understanding the potential uses of technology to differentiate instruction have been a concern for the teachers and students in a local school district located in the southeastern United States. Despite the emergence of digital voice assistants (DVAs) as tools for instructions, teachers lack knowledge and strategies for using DVAs to differentiate instruction in their classrooms. The purpose of this qualitative study was to identify teacher knowledge and strategies employed among special education (SPED) teachers using DVAs to differentiate instruction in their classrooms. The concepts of Carol Tomlinson's differentiation theory and Mishra and Koehler's TPACK framework served as the foundation of this study. The research questions examined middle school SPED teachers' perceptions of challenges using DVAs to differentiate instruction, resources, and strategies available to these teachers as well as their perceived knowledge of using DVAs to differentiate instruction. In this basic qualitative study, data were collected from 6 SPED teachers using semistructured interviews. Interviews were recorded, transcribed, and analyzed thematically. The findings suggest that teachers had little to no perceived challenges when using DVAs to differentiate instructions. However, the overutilization of DVAs might rob students of their ability to think independently. This study offers several prospects for future research related to the topic and findings. Further research is needed at the elementary and high school levels that may include core content teachers. The findings in this study serve as grounds for social change for schools and school districts to develop training solutions, policies, and guidelines for teachers to follow when implementing technology.

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Dedication

I dedicate this study to my father, Keith Weir. He had a very unorthodox and indirect way of motivating and celebrating my educational journey and successes. He passed away suddenly in October of 2017, so he is not here to celebrate this milestone with me, but this one is for him. To my dear mom, Celeste Weir, who worked assiduously and sacrificed everything she possibly could to ensure that I had a solid foundation. Your sacrifices are very monumental to the person whom I have become today, and I am eternally grateful to you.

To my loving sister, Asha Weir, who has been my rock, confidante, and source of a good laugh when I was at the brink of burning the books and to my brothers Rocky-Lee Weir and Oniel Edwards, I share this moment with you; one of us made it! To my daughter Ariqua Weir, who put up with all the neglect and missed fun opportunities throughout this process, I love you. Also, to all my friends and supporters who have listened and shared words of encouragement while I complained throughout this journey, I raise my hat to you.

Acknowledgments

I want to acknowledge my best friend, my heartbeat, my motivation, Ariqua Weir; this work is all for you, my love. Dr. Wayne Burnett for mentoring and guiding me through the process remotely. I would also like to thank all the members of the No Scholar Left Behind (NSLB) cohort for consistently being a reliable support system for venting as well as contributing scholarly advice.

I also want to acknowledge my committee members Dr. Suzzane O'Neill and Dr. Gladys Arome, for supporting and guiding me throughout this process. Thank you to all the educators who volunteered and participated in this study; I appreciate your dedication and support. To my friends, thank you for all your help and prayers that propelled me throughout this journey.

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Chapter 1: Introduction to the Study

Introduction

The future of education is naturally connected and dependent on the improvements in modern technologies and devices equipped with intelligence capabilities. Today, artificial intelligence (AI) has revolutionized how people go about their daily lives; this is no different in the way educators approach the teaching and learning process (Popenici & Kerr, 2017). Innovators and educators have been actively changing the dynamics of how teachers and students interact and engage with content-specific materials, by creatively developing and implementing devices and software to aid in disseminating information to learners. In the education field, developments in AI open up new plausible outcomes and difficulties in middle school pedagogy, with the possibility to generally change administration and the inward design of the foundations of education (Popenici & Kerr, 2017). In 1987, John Skully, former chief executive officer (CEO) of Apple Inc., posited that intelligent agents would be one of the main ways to interact with computer systems and how users gain access to public and private databases (Sculley, 1987).

Advanced computers using algorithms can serve people with variable capacities by concentrating on a particular degree of human-like processes and complicated assignments that can be used in special education (SPED) instructions for middle school. In this study, I explored the perceptions, possibilities, and potholes of middle school SPED teachers, who used AI as assistive technology, specifically digital voice assistants (DVAs), to differentiate instructions. Additionally, throughout this study, I focused on

how teachers integrate DVAs to differentiate instructions and the strategies used to differentiate SPED instructions.

Background

In 1968, IBM introduced the first digital voice recognition system that utilizes AI technology. With this development, several companies and manufacturers have caught on and adopted this innovation. Companies such as Apple, the innovators of Siri, Microsoft innovators of Cortana, and Google Voice have made advances in this innovation, making it more accessible in today's technology market. Smartphones and AI-enabled devices are becoming increasingly popular in today's technology market and the education sector. AI-infused DVAs such as Amazon Alexa (Echo), Siri, and Google Home have become more widely used as personal assistants. However, they have also made their way into classrooms. AI has the potential to make it much easier for students in massive open online courses (MOOCs) to find help from their peers (Gose, 2016). This utilization of AI is not uncommon, as it has been utilized in numerous business sectors. Nevertheless, as it advances into the classroom, this innovation is making waves. Consequently, Davie and Hilber (2018) proposed that Amazon Echo needs further research to build upon the authentic and longer-term advantages it has on pedagogy. In any case, the underlying discoveries recommend this innovation may be a significant expansion to instructions and the classroom.

Moreover, AI has the potential for advancement for an extended period. International Society for Technology in Education (ISTE) board member Hall Davidson, a senior executive of Discovery Education, says he sees the capability of AI to help

learners to increase learning and thinking as they utilize the gadgets to work on making inquiries and verbally process (Krueger, 2017). Additionally, AI technology may help teachers and learners to increase proficiency in specific subject areas (Thomas, 2016). In previous years, adopting these technologies would have been difficult. However, with the integration of AI technology in everyday life and devices such as cell phones and smart homes, adopting this technology has become significantly easier. As such, innovation and AI are engaging and empowering schools and instructors to accomplish more than they ever could previously, and it is evident through progressively shrewd applications intended to encourage teachers and students alike (Thomas, 2016).

According to the American Academy of Pediatrics, how learners interact with technology has changed significantly. In 1970, children started interfacing with television at age 4 years. However, today, the interaction with digital media begins as early as 4 (Reid Chassiakos, Radesky, Christakis, Moreno, & Cross, 2016). AI provides a way to stage changes to how educators deliver instructions in SPED classrooms. It is not only digitization of existing assets or showing improvements; instead, it includes another layer of significance worthy of conveying information-driven experiences and devices to empower access to discovering that primarily could not be accomplished without the intensity of the shrewd cloud (McNeill, 2018). As this happens, more students may become empowered and engaged in realizing who may proceed to be the makers of considerably more intelligent devices. Furthermore, developing software to help teach the students with SPED needs.

Problem Statement

Access to technologies and understanding the potential uses of technology to differentiate instruction has been a concern for the teachers and students in a local school district in the southeastern United States (Assistant principal, personal communication, July 3, 2019). The local school district comprises 14 schools, which include three elementary, three primary, two middle, one middle-high, two high, and three vocational schools. The school district enforces the "bring your own device" (BYOD) policy. This policy enables students to bring personal learning devices to offset the lack of technology offered to students by the district (Teacher, personal communication, March 6, 2019).

Additionally, Cantrell, Byrd, and Osman, (2016) reported that from a survey conducted, the local school district studied responded to the survey question, "number of schools in each district reporting no 1: 1 computing capability in the school." A total of seven schools reported having one-to-one student computing capabilities from a total of 14 schools that make up the district. These numbers show that 50% of the total schools do not have one-to-one student computer technologies. The report also stipulated that many districts misunderstood the question as it relates to BYOD versus district assigned devices. Hence possibly overstating their one-to-one computer technology.

Moreover, the "teacher knowledge of students" Item Number 10 on South Carolina (SC) 4.0 rubric for teacher evaluation, assess teachers' knowledge of their students. Also, how well they differentiate or tailor instructions to meet the need of their students (SC Department of Education, 2018). Raja (2016) postulated that students with learning challenges have varying difficulties, frequently covered up or inconspicuous,

that influence learning their entire lives. Raja (2016) also suggested that there is a remarkable reduction among students with learning disabilities when compared to general education students that use technology to differentiate instructions. Reports indicate that a small proportion of learning-disabled learners receive assistance from computer technology to help their learning results (World Health Organization, 2018). Mohamed (2018) suggested that SPED educators' sentiments of readiness ground their technology usage while working with students with learning challenges. Additionally, research showed that there is a lack of time, resources, and support from the administrative or leadership body of schools, which prompts a lack of computer usage by SPED teachers (Mohamed, 2018).

AI is not particularly new to the field of education. For example, AI has been used in education to create MOOCs, learning analytics, intelligent tutoring systems, education data mining, and computer-supported collaborative learning (CSCL) (Dillenbourg, 2016). However, with the introduction of AI technologies such as DVAs and chatbots, AI has become an increasingly popular instructional innovation used in classrooms that can facilitate different learning experiences (Davie & Hilber, 2018).

Consequently, these technologies are used within middle school classes to aid pedagogical development as purported by Dousay and Hall (2018). Furthermore, Koedinger and Aleven (2016) reported that more than half a million students are enlisted in courses designed with AI, such as cognitive tutors in software, web-based applications, or as stand-alone interfaces in more than 3,000 schools annually. Koedinger and Aleven (2016) confirmed that the field of AI in education is making significant progress in terms

of technological advancements. However, its effect on students learning outcomes has little to no data to support its usage in instructions in this school district. Moreover, Horn (2018) postulated that DVAs inclusive of Amazon Alexa and Google Home, among others, are used in lessons without adequate data to support their benefits in the classroom. Understanding and academic information to assist students and their instructors in the learning process with the use of DVAs is developing (Herold, 2018). The effects of AI in differentiated classrooms, where instructions tailored to the unique learning needs and learning style of their students were obscure or less explored as it relates to SPED instructions (Gulson & Webb, 2017).

The local school district does not mandate the use of DVAs; however, with a lack of technological resources and training on how to effectively differentiate instructions, teachers are forced to be creative in incorporating technologies to differentiate instructions to meet the 4.0 rubric requirement (SPED teacher, personal communication, February 2, 2019). The problem to be investigated in this study is, despite the emergence of DVAs as tools for instructions, teachers lack knowledge and strategies for using DVAs to differentiate instruction in their classroom. The local district requires policies and guidance on how DVAs can or should be applied. Through this study, I have established a foundation on which such policies and guidance can be developed and implemented within the local context.

Purpose of the Study

The purpose of this qualitative study was to identify teachers' perceptions, knowledge, and strategies employed among SPED teachers using DVAs to differentiate instruction in their classrooms. Additionally, throughout this study, I exposed knowledge gaps and missing/required strategies to improve implementation. Through this study, I established a foundation on which policies and guidance can be developed and implemented within the local context. Understanding the usage of these technologies in the classroom may offer teachers information regarding the benefits and or limitations that DVAs have on pedagogy. As a result of this study, further research and inquiry may be performed locally or nationally to examine best practices and schemes in place to implement DVAs as a learning tool to differentiate instructions in classrooms.

Research Questions

1. RQ1 – What are the perceived challenges faced by middle school SPED teachers using DVAs in differentiating instructions in SPED classrooms?
2. RQ2 – What resources and strategies are known to be available to prepare middle school SPED teachers for differentiating instructions in SPED classrooms using DVAs?
3. RQ3 – What is the perceived knowledge of middle school SPED teachers related to the usage of DVAs to differentiate instructions in the classroom?

Conceptual Framework

The conceptual framework for this study is based on (Mishra & Koehler, 2006) Technological Pedagogical Content Knowledge (TPACK) and Tomlinson (1999) differentiation framework. The TPACK framework was introduced in 2005 to promote the understanding and integration of technology in the education setting (Koehler & Mishra, 2005). The TPACK framework serves as a lens that educators can use to understand technology integration as the interplay between technology, pedagogy, and content (Koehler & Mishra, 2005). The TPACK framework presents the connections and complexities between the three essential types of knowledge (content, pedagogy, and technology) (Koehler & Mishra, 2008; Mishra & Koehler, 2006). At the point where the three classes of knowledge intersect, is an innate perception of content teaching with the appropriate academic technologies and techniques.

The Tomlinson's (1999) differentiation framework also complements the TPACK model, as the differentiation framework identifies three main elements that educators use to disseminate knowledge. These aspects include content that is what learners learn, method, and how they make sense of content; and product that encapsulates how learners demonstrate what they have learned (Tomlinson, 2014). By identifying these three components, instructors offer distinctive ways to deal with what students learned, how it is learned, and how they exhibit what they have realized (Tomlinson, 2014). Furthermore, differentiated instruction (DI) is a learning perspective that asserts that learners learn best when educators satisfy them at their level and interest. A key objective of DI is boosting the learning capability of each student (Tomlinson, 2001, 2003). There is no prescribed

way of differentiating instructions in the classroom. However, there are specific guidelines, which, whenever pursued, are likely to improve practice and cater to the needs of diverse learners along with accommodating multiple learning styles. The TPACK and differentiation frameworks paved the way to further delve into teachers' perceptions of using DVAs to differentiate instructions in SPED classrooms. This framework informs, and is informed by, the research questions and helps to identify research design decisions, such as the method of inquiry and data collection and analysis.

Nature of the Study

The nature of this study is qualitative and utilized a basic qualitative design approach. A basic qualitative study is used to describe a general essence or understanding of a problem or topic in question (Merriam & Tisdell, 2016). This type of qualitative researcher focuses on the process rather than outcomes; this type of research focuses on understanding how people assimilate and adjust to their lives and experiences (Creswell & Creswell, 2017). A basic qualitative study is best suited for studies where there is a general body of information available. However, I would like to better understand the topic or problem from a specific group of participants (Percy, Kostere & Kostere, 2015).

In contrast to quantitative research, which depends on specific narrow questions and the analysis of numbers, qualitative research focuses on broader open-ended questions. Whereas quantitative research aims at testing the general laws of behavior, phenomenon, or theory, a qualitative study seeks to understand an individual or group's societal reality close to how the participants lived or experienced the phenomenon (Denzin & Lincoln, 1994). The qualitative methodology aligns with this study's problem,

purpose statement, and research questions, and it is best suited to address the problem and research questions of this study.

The basic qualitative study design focused on the process of a phenomenon. For this research, I focused on the perceptions and experiences of middle school SPED teachers who participated in semistructured interviews in the research process (Yin, 1994). The elements that define a semistructured interview are the scheduled questions that are guided by particular topics in a structured and orderly way. This technique is quite the perfect instrument as it provides one more flexibility in questioning and reacting to accessibility and, more importantly, its ability to provide unrequested human and organizational behavior data. A semistructured interview is often the most efficient and convenient way to collect data (Kvale & Brinkmann, 2009).

Because of semistructured interviews position in the rational discussion, it offers the interviewer with the ability to change the style, and general order of issues to encourage the interviewees more when they respond. Moreover, it gives the interviewees a sense of freedom to respond in a manner that reflects how they think and speak, using their terms and expressions. Semistructured interviews are exceptionally priceless to researchers as it gives the interviewee's raw and uncensored perception of the social world during a case or study (Kvale & Brinkmann, 2009).

This strategy for research is both inductive and adaptable, taking into consideration an all-encompassing methodology that encourages a rich comprehension of the phenomenon examined. In this study, I selected a sample of middle school SPED teachers who participated in an interview. In this study, I used semistructured interviews

intended for 10 to 12 SPED teachers to gauge their perspective on the use of DVAs in their instructions. Interviews enable the researcher and subjects to dig deeper and uncover a more personal and descriptive understanding of the phenomenon investigated that may not be identified easily from observations (Creswell, 2008).

I started by coding the information after transcribing, acknowledging the themes of the interviews (Charmaz, 2014; Creswell, 2013). For data analysis, I assigned codes to the significant statements identified in the annotation process of the transcripts. I then transferred the data into NVivo 12 qualitative data management software to facilitate coding and analysis. This study design reduces the researcher's personal views on the problem. It focuses on understanding the participants' own experiences to eliminate biases (Nieswiadomy, 1993).

Definitions

Highlighted below are definitions of keywords and terms associated with AI and differentiation:

Algorithm: A step-by-step procedure for calculations, used for data processing and automated reasoning (Stanimirović, 2017).

Assistive technology: "An assistive technology device is any item, piece of equipment, or product system, whether acquired commercially off the shelf, modified, or customized, that is used to increase, maintain, or improve functional capabilities of a child with a disability" (Individuals with Disabilities Education Act, 2004a, sec. 300.5).

Artificial intelligence: Computer systems able to perform tasks that usually require human intelligence, such as visual perception, speech recognition, decision-

making, and translation between languages (Beyer, 2018). This implies that DVAs get more intelligent (smarter) over time. It becomes acquainted with the individual, gaining from every communication, which eventually becomes personalized and more efficient. The device likewise winds up being more intelligent through scale, by accessing interactions from all users to improve (Bing, & iProspect, 2017).

Machine language: An application of AI that provides systems with the ability to learn and improve from experience without being explicitly programmed automatically. Machine learning focuses on the development of computer programs that can access data and use it to learn for themselves (Beyer, 2018).The process of giving a computer a sample set of data and getting it to "learn" without the need to program explicit instructions.

Natural language: The "language that is used for everyday communication by humans; languages like English, Hindi or Portuguese." (Bird, Klein, & Loper, 2009, p. ix)

Chatbot: "Chatbots are computer programs that interact with users using natural languages" (Shawar & Atwell, 2007, p. 29). These are computer programs that carry on a conversation with a human via text and or speech while convincingly passing as a human.

Digital voice assistant: "A digital assistant is a computer program leveraging AI that can understand a variety of inputs (text, voice, data) in order to answer questions and carry out tasks for an individual" (Bing, & iProspect, 2017, p. 7). They influence innovation to provide a personalized experience to every user.

Differentiation: Alludes to the instructional process that enables educators to modify the content of their instructions, the procedure of instruction, and the assessment of learning tailored to the needs of individual learners (Tomlinson, 2014).

Special Education is defined as "Specially designed instruction, at no cost to parents, to meet the unique needs of a child with a disability" (Individuals with Disabilities Education Act, 2004b, Sec. 300.39).

Assumptions

This study presents the following assumptions:

1. Since the use of DVAs is so widely used, all middle school teachers know how to implement and incorporate these technologies in their daily instructions effectively.
2. Participants will be cooperative through the research process.
3. Teachers will know what differentiation is and the process of differentiation.
4. Participants will be honest in their interview, which reflects accurate perceptions of the technology.

Scope and Delimitations

I conducted this study in a school district in a southeastern state with middle school SPED teachers. Teachers at the middle school level in this district teach students from Grade 6 to Grade 8. SPED teachers teach various content areas across the South Carolina curriculum. The teachers have been using DVAs in their classrooms to assist with instructions. However, there was no knowledge or any formal training provided by

the school district for the implementation of these devices. I used semistructured interviews to collect the information for this research with open-ended questions.

The study is limited to middle school SPED teachers using DVAs, which are popular personal devices used in instructions; they are mass-produced by various technology innovators. I restricted the study to two specific DVAs devices: Alexa by Amazon and Google Home by Google. These digital assistants are commonly used in instructions for student engagement and differentiation purposes. Additionally, I limited the study to the lived experiences of teachers that utilize these technologies to differentiate instructions. As a result of this, the outcomes of the study may not reflect the experiences of teachers that may have experience using other DVAs in their content area instructions. This research is also restricted by design to the technique of collecting information from semistructured interviews. However, the nature of these interviews affords the participants and me the ability to delve deeper into the prospects of AI.

Limitations

This study is limited to the available middle school classrooms in the small school district in a southeastern state to explore the specified technology in this qualitative study. This study used a sample that represents a small school district in a southeastern state. The district is located in a southeastern state, which means it pulls teachers and students from the inner city and rural areas outside the more densely populated tourist and central locations. The results gathered from this may not be generalized to other school districts of larger or similar demography.

Additionally, the participants of this study were limited to SPED teachers teaching Grades 6, 7, and 8. This study did not take into consideration the perceptions of other content area teachers that may have used DVAs as a differentiation tool. Because there are a set amount of interview questions, the study is limited to the amount of data captured within the time frame of the interviews. Nevertheless, the format of the semistructured interview afforded the interviewer and interviewees to explore questions described in the interview protocol.

Significance

In this study, I informed stakeholders such as school districts, school administrators, educators, students, and parents about the possible uses of the DVA innovations such as Amazon Echo (Alexa) in middle school SPED classroom instructions in a school district in the southeastern United States. Schools and classrooms will continue to be the leaders of how classroom innovations influence differentiation, social interaction, and communication as technology continues to evolve (Hoy, 2018). Amazon Echo (Alexa) and other DVAs are of particular interest, as recent years have seen an expansion in both the enthusiasm around, and usefulness of, DVAs, both in smartphones and personal home technologies like Siri by Apple and Google Home by Google (Rao, 2016). This research may offer a suitable premise for schools and school districts to examine these developing and groundbreaking innovations, whether Amazon Echo (Alexa) or any of its competitors that provide similar functionalities.

Additionally, the outcome of this study may offer schools and school districts grounds for developing policies and guidelines surrounding the usage of DVAs in the

classroom. Also, the result of this study may provide a resolution to establish professional development or training sessions to prepare teachers for differentiating instructions. Professional developments may increase teachers' knowledge and the potential to provide them with the "know-how" to differentiating instructions.

Although teachers frequently work one-to-one with students, for a particular period and or in self-contained spaces, DVAs can be collaborative, central, and or personal (Roll & Wylie, 2016). Also, the findings in this study may influence how educators implement AI or other technologies to engage students in SPED classrooms and develop their social interactions with teachers and students, students and their peers, and students and technology (K. Wu, 2017). Examining AI technologies to differentiate instruction in SPED classrooms, as well as investigating teachers' utilization of AI technology, may reveal how the developing innovation of DVAs can influence these technologies being incorporated in the classroom. Consequently, the importance of this study heavily relies on the potential to impact decisions and policies related to the use of DVAs to differentiate instructions in middle schools in the local district. By identifying the resources and training needs of SPED teachers differentiating instruction, school boards, and faculties of education may be better positioned to support those teachers.

Given that the student population is composed of SPED students in a low income, low performing area, implementation of initiatives to support teachers may lead to improved learning in the classroom, giving these disadvantaged students a better chance of completing high school and entering and succeeding in post-secondary education.

Additionally, these decisions and policies could further be extended to other school districts to improve similarly faced technology implementation issues in the classroom.

Summary

AI and the Internet of Things (IoT) have influenced how teachers and students interact and progress through content with technology (Reid Chassiakos et al., 2016). Teachers are forced to be creative in their craft in order to keep up with the evolution of technology and address the dynamics of diverse learners in the classroom. DVAs are relatively novelty innovations used as a differentiation tool in the classrooms, which includes middle school classrooms. Given the need to evaluate technologies in terms of their effects on students' learning outcomes, a careful analysis of DVAs such as Alexa can provide school districts, schools, and teachers with vital information on their impact on students' learning outcomes. In Chapter 2, the review of literature offers a broader understanding of DI, differentiation in SPED education, supporting teachers with technology, AI, AI in education, DVAs, DVAs in education, and the consequences of using DVAs.

Chapter 2: Literature Review

There are numerous issues encountered by educators, which include but not limited to disparities in learning deviations in students' where the learning environment, learning readiness, and the learning profiles of students assume a colossal job. These issues have been investigated by researchers in education to develop suitable methods of teaching to accomplish desirable learning outcomes. Researchers have concluded that one strategy to deal with low levels of attainment due to differences is to differentiate teaching, teaching materials, and teaching approaches based on individual needs and learning styles (Siam & Al-Natour, 2016).

The problem that I investigated in this study was, despite the emergence of DVAs as tools for instructions, teachers lack knowledge and strategies for using DVAs to differentiate instruction in their classroom. The local district requires policies and guidance on how DVAs can or should be applied. The purpose of this qualitative study was to identify teachers' perceptions, knowledge, and strategies employed among SPED teachers using DVAs to differentiate instruction in their classrooms. Through this study, I sought to establish a foundation on which policies and guidance can be developed and implemented within the local context. The literature review uncovers current trends in the use of DVAs (frequency, subject area, purpose, etc.), and suggestions for how teachers use DVAs in SPED classrooms catering to the needs of learners with varying learning abilities.

Literature Search Strategy

I conducted the literature review related to AI, DVAs, and differentiation in the classroom using the Walden University library to retrieve literature. The primary sources of this study include ProQuest, EBSCOhost, Sage Publications, Taylor and Francis, and ERIC. I retrieved information from these sources using the following key terms: *artificial intelligence in the classroom, personal voice assistants in the classroom, Alexa in education, digital voice assistants in the classroom, challenges of using digital voice assistants in the classroom, differentiation, and differentiated instructions.* The key terms that I used in the literature retrieval originated from the problem and purpose statements.

Additionally, I further explored the authors and titles retrieved from these sources relating to AI in the classroom using internet searches to expound on the topic. From the review of literature, several themes emerged, namely SPED instructions in middle school, differentiated instructions, differentiation in SPED education, technology in differentiation, supporting teachers with technology, artificial intelligence, artificial intelligence in K-8 education, digital voice assistants, digital voice assistants in education and impact of digital voice assistants. The literature review provides a comprehensive discussion of the themes highlighted.

Conceptual Framework

Chapter 1 provided a discussion of the framework used in this study. This chapter provided additional elements vital to the choices of the conceptual framework. The framework for this study, DI can be realized through the framework context of (a)

Tomlinson (1999) framework of DI, which describes engaging and accommodating diverse learners with a variety of instructional strategies which meet learners at their level; and (b) Mishra and Koehler (2006) TPACK based on the three different knowledge used to effectively implement and incorporate technology in instructions.

Differentiated Instruction

The principles of differentiation evolved from the central tenets of Lev Vygotsky's social constructionist theory, as well as the constructivist theory, theorized by Jean Piaget's (Tzuo, 2007). Howard Gardner first promulgated DI (Tzuo, 2007). Additionally, differentiation derived from a variety of learning theories, which is inclusive of Howard Gardner's theory of multiple intelligence. Differentiation also incorporates the tenets of Dunn and Dunn and Kolb's philosophy on learning styles (Tzuo, 2007). Furthermore, social constructivism purported by Vygotsky (1978), which highlights students actively engaging in the teaching and learning process, also forms the basis of DI.

Although conceptualized by other theorists, DI is spearheaded by the work of Tomlinson (1999), setting the establishment for research on DI for researchers (Bender, 2012). Hence, her model is adopted and received as the conceptual foundation for understanding the implementation of DI in the current research. Tomlinson (2014) characterized the DI model as a student-centered model of instruction that recognizes the uniqueness in students' learning styles, inspiration, capabilities, and readiness to learn. Given these variables, this model identified four different ways in which instructors can differentiate instruction. DI encapsulates a method for teachers to reflect on practices to

adjust and modify lessons continuously. DI is intended for planning lessons to meet the unique learning needs of students based on the level they are on (Tomlinson, 2014). Gardner's (1992) theory of multiple intelligences stipulated eight different learning intelligences: visual, naturalist, interpersonal, intrapersonal, kinesthetic, musical, mathematical, and linguistic. These are names or indicators given to distinguish individuals' learning styles. However, Tomlinson (2014) concluded that (a) individuals think, create and learn differently; (b) learning is developed by matching learning objectives to the applications of learners' abilities in the teaching and learning process, and (c) individuals learners require a variety of prospects to discover and develop their capabilities with an assortment of intelligence. Tomlinson (2001) identified content, process, product, and the environment as the primary components of the DI model.

Tomlinson explains these four components as follows: "(1) content - what the student needs to learn or how the student will get access to the information; (2) process - activities in which the student engages in order to make sense of or master the content; (3) products - culminating projects that ask the student to rehearse, apply, and extend what he or she has learned in a unit; and (4) learning environment - the way the classroom works and feels" (Tomlinson, 2001, p. 2). DI has influenced educational practices resulting in significant modifications to curriculums both locally and globally. Kamarulzaman, Azman, and Zahidi (2017) reported curriculum changes as a result of the evolution of DI.

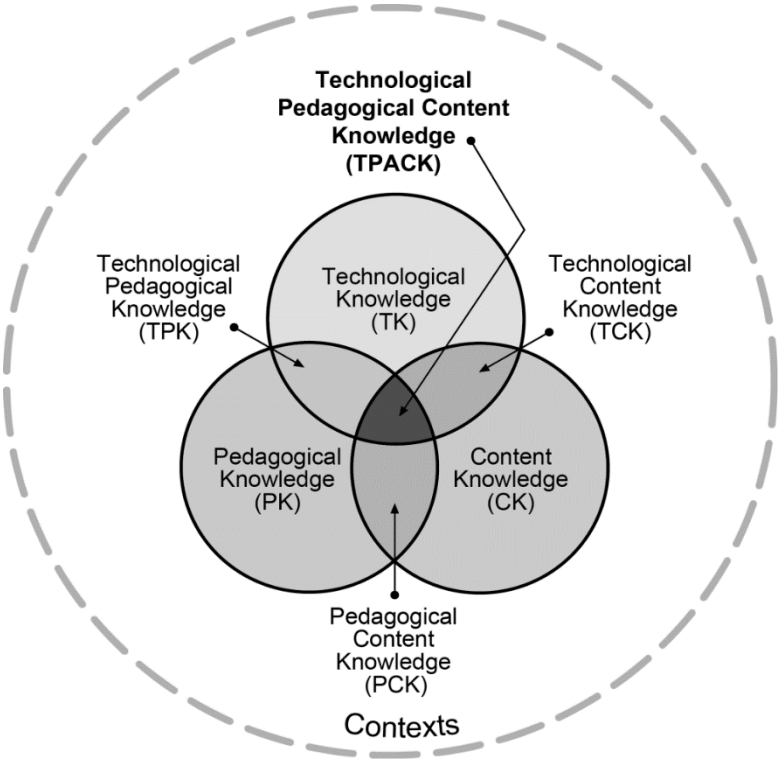
Technological Pedagogical Content Knowledge

Additionally, the TPACK was initially used as a theoretical framework to assist with understanding educators' knowledge of effectively integrating and implementing in education (Mishra & Koehler, 2006). The TPACK framework expanded upon Shulman's (1987) pedagogical content knowledge and conceptualized how the content knowledge, pedagogy, and technology collectively shaped innovative content-specific learning experiences. Educators, as well as other professionals, utilized the TPACK framework to identify or describe what educators should know to be effective in integrating technology in the teaching and learning process.

Moreover, the TPACK framework focuses individually on the knowledge of technology, pedagogy, and content, as well as the combination of intersections holistically. This constitutes the seven types of knowledge purported by Mishra and Koehler (2006): Content, Pedagogical, Technological, Pedagogical Content, Technological Content, Technological Pedagogical, and Technological Pedagogical Content Knowledge. Figure 1 highlights the intersections of the various types of knowledge which formulates the TPACK. The TPACK framework guides teachers in designing student work that is the right fit for technology tools, content knowledge, and instructional strategies.

Figure 1

Venn Diagram of TPACK



Note. The TPACK Image. Reproduced by permission of the publisher, © 2012 by tpack.org.

Figure 1 shows the three outer spheres. Content knowledge (CK); this refers to the content educators are teaching or the material they want their students to learn (Mishra & Koehler, 2006). For example, students should have a full understanding of the Marketing Mix as it relates to a standard or objective in the Marketing course curriculum. Pedagogical Knowledge (PK); incorporates educators knowing their students and how they learn, as well as applying instructional best practices to meet learners' needs (Mishra & Koehler, 2006). Technological Knowledge (TK); refers to educators knowing the technologies that are available to them and proficient knowledge to use them but also

appropriate for the lesson (Mishra & Koehler, 2006). The Pedagogical Content Knowledge (PCK) refers to educators recognizing the best practices for teaching specific content to particular students. The Technological Content Knowledge (TCK) acknowledges how the technological tools accessible to educators can improve or alter how to transfer content to learners and ways in which learners interact with the technology. The Technological Pedagogical Knowledge (TPK) emphasizes how technological tools are used as mediums to achieve the desired learning experiences and outcomes of learners. In the center of figure 1, where PCK, TCK, and TPK intersect is the TPACK (Mishra & Koehler, 2006).

Additionally, the TPACK framework helps to guide educators on the propensities, affordances, and limitations of technologies, which allows them to be better suited for specific tasks over others (Koehler & Mishra, 2009). For example, emails afford users asynchronous communication and organization of conversations as well as storage; however, emails do not foster synchronous communication like that of video calling or face-to-face interactions. Being able to construe these capabilities and limitations of technologies allow educators to assess the type of technologies they use to teach specific skills or content.

Literature Review Related to key Concepts and Variable

Differentiation/Differentiated Instructions

The foundations of DI traced back to the one-room school building, inclusive of students of different ages (Tomlinson, Brimijoin, & Narvaez, 2008). In this type of school setting, educators are in charge of guiding learners of varying learning abilities.

Each student is unique and does not have the same learning modes as well as learning needs since they may adapt contrastingly and at different levels. Instructions should include materials that interest the learners and spark their enthusiasm, to better create specific learning outcomes (Khan, Egbue, Palkie, & Madden, 2017).

Differentiation is a method of teaching students; some may consider it to be a set of worksheets and or programs, which is far from what the differentiated process is Tomlinson (2014). This practice in the classroom allows teachers to get to understand and know their learners individually to provide all the requisite support and instruction that will bring about positive student outcomes. Tomlinson (2014) postulated that differentiating instructions implies giving learners a variety of options for learning. This method of teaching suggests that teachers observed and comprehend the distinctions and similarities among learners and utilized the data to design individualized instructions tailored to learners' needs.

Currently, research experts and analysts examined the view of one-size-fits-all when instructing in the classroom (Brezicha, Bergmark, & Mitra, 2015), and a substantial number of examinations showed the utility of various approaches of differentiation on the scholar's accomplishment; yet, instructors, today are using traditional systems for teaching with no differentiation included in their classroom instructions. Tiering is one way to differentiate assignments in the classroom. Cuevas (2015), Tomlinson (2014), and Wormeli (2005) described *tiering* as an adjustment in the learning experiences of students to create meaningful learning for the varying levels of students. For instance, some students may compose a single paragraph summary based on assigned reading materials,

while other students may work on a project to show what they have learned. Additionally, using the *tiering* strategy implies that learners read various books since each student learns at varying paces and are at different levels.

The teaching of content-specific information and abilities necessary in the differentiation process incorporates learning about a plethora of pedagogical models and instructional strategies and tips on how to execute and modify these lessons to meet the specific learning needs of students (Renzulli, 2016; VanTassel-Baska, & Hubbard, 2016). Coubergs, Struyven, Vanthournout, and Engels (2017) confirmed that in today's diverse and multicultural society, there is a profusion of differences among researchers which teachers will need to deal with and manage reliably. As such, the onus is on teachers' openness and commitment to learning how to differentiate and meet the different learning needs of today's diverse learners with emerging innovations such as DVAs. While educators direly need this fundamental knowledge and skillsets to differentiate instructions effectively, the administrators and department heads likewise need to realize how best to support teachers with cutting-edge practices to deliver rigorous and DIs (Tomlinson, 2014).

Differentiation in SPED Education

Elementary school level reading teachers differentiate their reading content by using the guided reading strategy (Fountas & Pinnell, 2017). However, studies have shown that as students progress beyond the fourth-grade level, they become more independent readers. Progressively, as students transition to the middle school level, they

become less avid readers as their interest level in reading declines as compared to earlier years (Alvermann, Unrau, Sailors, & Ruddell, 2018).

Ness (2016) reported that at least 70 percent of middle-level students need learning instructions differentiated that caters to their unique learning needs. Regardless of where students originate from, whether from a more privileged class or from a low-income background, or learners who communicate in English as a second language or learners with learning difficulties; 70 percent of these students will benefit from teachers providing DIs (Ness, 2016). This data is beneficial to teachers and used as a basis when planning lessons for their students. The Common Core curriculum mandates that students learn a set of materials and produce a set of products within which there is little room for DI. Regrettably, this deserts such a large number of learners as opposed to propelling them ahead when instructions are differentiated (Tomlinson, 2015).

The lack of DIs in numerous classrooms limits the potential accomplishments of students with learning disabilities (Suprayogi, Valcke, & Godwin, 2017). SPED learners need appropriate instructions with proper rigor to keep them fully engaged, stimulate their curiosity, and to keep them from being exhausted and unproductive in class. If proper educational programs and learning opportunities are not in place, these learners may not accomplish their full potential (Yuen et al., 2018). Be that as it may, if students can customize and take responsibility for learning, they will almost certainly exude their true abilities. Shockingly, it regularly appears that instructors might not necessarily know all the different learning needs and accommodations for the students in a general classroom setting, or educators don’t have the requisite skills to provide the kind of

learning exercises that SPED learners require (Yuen et al., 2018). Further, researchers added that it is increasingly alluring for instructors to be centered around improving learner capability through the advancement of abilities, experiences, information, and learning dispositions (Hymer, Watkins, Dawson, & Buxton, 2015).

Supporting teachers with technology

Teachers need guidance from their superiors on the best way to improve their instructional method and fuse innovative technology into their lessons. Today's age of learners in the classroom are tech-savvy and considered as tech intrinsic (Ahmadi & Reza, 2018). Since this group has experienced childhood in a cutting-edge technological society, they think outside of the box. More technologically inclined, which is not quite the same as past ages. As teachers, it is significant to develop foundational conditions in training that help and support a development outlook for these learners while enabling them to use their specialized ability (Ahmadi & Reza, 2018). E. Wu (2017) also confirmed that teachers should receive step by step instructions on how to differentiate in their classrooms as well as providing teachers with access to the fidelity data of implementing new devices necessary to differentiate instructions effectively.

Bennett, Lockyer, and Agostinho (2018) posited that innovation presents fundamental but essential changes that are necessary for achieving significant upgrades in learning outcomes. Hur, Shannon, and Wolf (2016) reported that teachers influence students' engagement in the classroom by using technological-aided devices and tools. Interactive writing activities, as well as educational games, contribute to increased student engagement. Used to assist in the teaching and learning process, technology

infuses learning environments with cutting edge learning devices, for instance, personal computers (PCs) and smart devices; broadens interactions in online courses, experiences, and learning materials; supports learning 24/7; produces 21st-century skills; extends students responsibility and motivation, and also speeds up the learning process (Bennett et al., 2018).

Throughout the years, numerous reports point to educators proceeding with challenges implementing technology into classroom learning experiences. In spite of access to technology and regardless of the way that beginner educators are entering the classroom, with unquestionably further developed technological abilities than their colleagues of a previous age, just 39% of instructors report moderate or successive utilization of technology as an instructional device and 40% of educators stated that innovation is helping them achieve learning targets (Ding, Ottenbreit-Leftwich, Lu, & Glazewski, 2019).

Consequently, one reason for the effective implementation of technology in classroom instructions is the support and formal training an educator gets with best practices on how to integrate technology in their instructions. Numerous educators report that the support they have received in technology integration, regardless of whether it is face-to-face or virtual, is still excessively centered around figuring out how to utilize the innovation as opposed to coordinating it into the teaching and learning process (Ahmadi & Reza, 2018). In other words, teachers can more easily get technical training on using technology than the pedagogical training they need to make it part of teaching and learning.

Today, students enter the classroom, prepared to utilize technology to investigate their reality. Studies have demonstrated that technology can expand students' inspiration, confidence, the frame of mind, and engagement while augmenting organization and study skills. Every one of these variables together was found to substantially improve the school's participation and scholarly execution (Carver, 2016). Carver (2016) also established that students instructed in an environment that has 1:1 technology outperformed students with instructions delivered in a traditional classroom environment when required to complete computer-based assignments. Carver (2016) also found that learners in a technology-rich environment performed better in nine of the 15 proficiency skills evaluated. This improved scholarly exhibition is especially significant because a considerable portion of the high stakes standardized evaluations are now computer-based (Carver, 2016).

Gamage and Tanwar (2017) suggested that understanding the general factors influencing technology utilization is significant for school administrators or educational systems as they attempt to present a specific innovation or to select the better of two technologies. Frequently, educators receive training in the utilization of technology; however, they are not consulted with regards to the effectiveness of said technology.

Kafyulilo, Fisser, and Voogt (2016) postulated that personal factor encapsulates the change in education that forms the basis for what a teacher does and cogitates. Furthermore, Kafyulilo et al., (2016) added that if an instructor incorporates instructional technology that is user-friendly and they are comfortable using it, they will muster the courage to integrate technology in their classrooms actively. Additionally, teachers will

also be interested in professional development sessions centered around integrating technology in the learning environment once they have seen the benefits of how it will enhance their knowledge and overall practice in the classroom (Kafyulilo et al., 2016).

The comfort and ease of use of technology in the classroom are also dependent on the professional development and training offered by an institution. Kafyulilo et al. (2016) cogently added that a significant factor that surrounds professional development offerings encapsulates satisfaction levels with one's skillsets. Consequently, if a teacher receives training on how to integrate technology, they will have an appreciation and have more interest in turnkey and incorporate what they would have learned in training in their classrooms. Kafyulilo et al., (2016) confirmed that for a professional development session to be productive and successful, the teachers should be actively involved in taking their different learning needs and actively be part of various opportunities for learning that specifically focused on their school, and continuously support a collaborative teaching and learning process.

Tondeur, Pareja Roblin, van Braak, Voogt, and Prestridge (2017) posited that a significant issue, as suggested by first-year teachers, is that there are not enough guidelines or instructions on how to incorporate technology efficiently to augment the teaching and learning process. Additionally, Kafyulilo et al. (2016) added that importantly, teachers should not only acquaint themselves with different technological applications, but they should learn how to use them appropriately.

Also, the most influential factor related to the use of technology after teachers gain exposure to professional development sessions is grounded in the school's vision,

and mission, mainly through the institution's school leaders use of rewards and incentives to push and motivate teachers as purported by Kafyulilo et al. (2016). Eickelmann (2011) suggested that additional institutional factors could be support for different stakeholders in schools, peer support, involvement in critical decision making, and access to technology.

In addition to factors of professional development, schools with limited or no access to resources affect instructors' ability to be successful in implementing various technologies. Kafyulilo et al. (2016) stated that schools or school districts with limited technological resources constitute a significant blow to the effective implementation of technology by teachers in the classroom. Furthermore, factors such as the availability and location of electrical outlets are significant environmental factors for consideration for teachers to be successful with any technological implementation in education (Kafyulilo et al., 2016).

In addition to personal preferences, availability of professional development or training, and institutional/environmental factors, technological factors are also a significant issue in supporting teachers with continuous use of technology. An innovation's effectiveness and ease of use are also determinants in supporting teachers with using technology. Davis's (1989) technology acceptance model (TAM) identified the perceived usefulness (PU) and perceived ease of use (PEU) of technologies used in education. A technology's perceived usefulness characterizes the potential end-user's subjective probability that the utilization of a specific innovation (e.g., AI) will enhance his or her activity, and the perceived ease of use alluded to how much the potential end-

user anticipates the objectivity, learning curve and how easy the innovation is to use (Davis, 1989).

Bakir (2016) recommended that the successful integration of technology has been necessary to the discussion in schools and educator planning programs. Accentuation on the effective use of technology in K–12 schools to enhance learner's achievement has extended the critical need to appropriately prepare and provide instructors with the requisite knowledge skills and abilities to drive rigorous instruction. Universities or colleges that train educators can, in a general sense, improve K–12 innovation utilization by providing teachers with the requisite know-how and how to integrate technology in their lessons effectively. This is especially the circumstance if these teachers have the essential learning and capacities to use and coordinate innovation in the academic procedure.

As digital pioneers, instructors should cultivate systemic conditions in the classroom that supports and encourages a growth mindset, thus enabling them to be technologically proficient. School leaders must provide teachers with the requisite skillsets to effectively implement and use technology to their full potential in the classroom, not only to increase engagement but develop higher-order thinking skills.

Artificial Intelligence

With advances in the IoT, especially AI, and faster computer processors, we can input a large amount of data, which allows them to make inferences and mimic human-like behaviors. The introduction of technologies that learn from human interactions revolutionized a new era of how students are taught and learn. Given the significance of

connections in social development, AI will augment instead of replacing teachers from various perspectives. It is the expectation that educators will collaborate, as well as with smart machines. In many different business sectors, augmentation has prompted automation with the potential of a massive human workforce displacement. For example, approximately 20% of Amazon's labor force are robots (Ford, 2016).

Artificial Intelligence in Education

Adaptive learning (Aroyo et al., 2006) through tailoring and customization (Pane, Steiner, Baird, & Hamilton, 2015) with keen awareness to the learning styles of students (Kolb and Kolb, 2005), were the main areas that triggered this research of AI in education. Goksel and Bozkurt (2019) posited that the crucial awareness to learners suggested the implementation and usage of AI in the classroom should be grounded based on continuously meeting the needs of the students and provide them with learning opportunities based on the individual learning style(s) of students. As such, as opposed to embracing a "one size fits all" approach, the utilization of AI in instruction takes into consideration personalized teaching by enabling the teaching and learning process to be student-centered.

In education, AI has been a pivotal point in online learning, especially in writing classes. AI is the technology used to provide feedback in writing systems powered by machine learning such as Grammarly, Turnitin, WriteLab, PEG Writing, and Write to Learn, which is becoming increasingly popular in K-8 classrooms. Rather than the conventional classes, the students and the instructors interact with the Internet, which infers that we can invite AI into the teaching and learning process (Machajewski, 2018).

However, McRae, Ellis, and Kent (2018) and Timms (2016) suggested that there is no uncertainty that the AI technologies have innovations that are creative and transformative, yet there seems, by all accounts, to be little discussion about the more extensive impact of DVAs on instructions, except on the suggested benefits. One-to-one instruction has always been an effective strategy used in the teaching and learning process. Luckin, Holmes, Griffiths, and Forcier (2016) argued that one-to-one instruction is untenable for all students as there are not enough human teachers to address their needs. AI provides the opportunity to facilitate one-to-one instruction.

Digital Voice Assistants

Voice assistant/recognition technologies have been continuously developing in personal computing for over eight decades (Swamy & Ramakrishnan, 2013). Moore (2017) suggested that devices such as Dragon Naturally Speaking have been available to the general public since the 1990s, yet have discovered little usage beyond specialty utilization, such as with individuals who are physically impaired or unable to type. Han and Yang (2018) postulated that a DVA or intelligent personal assistant (IPA) is a voice recognition software or device that gives proficient, specialized, and social help to human clients via robotizing and facilitating numerous everyday exercises. Jimenez (2015) cited that consumer technologies are tools often used in the classroom to engage students in instructional materials. The author also suggested that technology is imperative to student engagement in the classroom. As an expert or clerical assistant, DVA can help clients on various daily assignments, for example, sending emails and instant messages, setting reminders and timers, arranging timetables, and requesting food (Han & Yang, 2018;

Pais, Casal, Ponciano, & Lourenço, 2015; Santos et al., 2016). On a more technical spectrum, DVA performs functions that incorporate the execution of more complex duties, for example, securing homes and controlling smart appliances, or checking the status of a patient's health by monitoring his or her vitals from a wearable device (Han & Yang, 2018). Goksel and Mutlu (2016) and Bozkurt and Goksel (2018) acknowledged that the use of DVAs in instruction has a promising future in the education field but requires more quantitative and qualitative research.

As a component of its social-emotional abilities, a DVA can interact with humans in a manner in which replicates the interactions with other human companions (Han & Yang, 2018; McDuff & Czerwinski, 2018). DVAs accumulate information and patterns relevant to users' interactions and behaviors by interacting with them or gathering awareness data, for example, location and time. As such, DVAs adapt to the user's needs and activities to improve their functionality (Santos et al., 2016). The incorporation of DVAs in the IoT arena can improve these technologies' abilities to acquire learning and awareness about their surroundings. DVAs may stunningly better the inclinations of their users by learning through their associations with other smart devices. For instance, a DVA could get familiar with the morning activities of a user by collaborating with another synced intelligent device on the network (Santos et al., 2016). Given these functionalities, DVAs have the ability to gather awareness data to improve the assistants they can offer students in the classroom environment.

DVAs have turned out to be ubiquitous in our daily computing usage as a result of the IoT. With the likes of Apple's Siri, Google Assistant, Microsoft Cortana, and

Amazon's Alexa or chatbots for training and enhancing the customer service experience, most users are acquainted with the idea of personal assistants (PAs) (McDuff & Czerwinski, 2018). Smart speaker DVAs are the most common type used on the market. These gadgets are utilized for daily tasks, for example, organizing meetings and controlling household electronics through automation. This multi-functioning capacity nature of smart speakers establishes a multi-tasking experience for users, where a task is a need for information or a goal that a user needs to fulfill. All previously mentioned DVA devices are designed and developed to provide comfort and ease day to day activities through fundamental and essential data on demand. As such, "by replacing a human being with actions in response to voice commands, these electronic devices help users who hesitate to interact with others and feel shy to ask queries or seek help in real life" (Lodhi, Mishra, Jain, & Bajaj, 2018).

Digital Voice Assistants in Education

The concept of DVAs or comparable technologies used in the instructional context as a teaching aid or educational device is not a new idea (Baylor, 1999) but became very popular in the 2000s. The use of DVAs in education is a relatively new phenomenon, which alluded to the gap in knowledge and research in the middle school (k-8) settings. However, there is continuous research of DVAs on a more extensive consumer scale that can inform some aspects of the educational environments. Dozens of assistive technology features that benefit learners with special needs have improved in the last two years, including voice recognition, text to voice, and text modification.

These innovations can assist students by customizing the teaching and learning experience and establish tailored educational opportunities through considering the potential differences among students (Dizon, 2017; Jean-Charles, 2018; & Pais et al., 2015). The natural language process (NLP) is necessary for these systems to produce smoother, human-like interactions (Han & Yang, 2018) and possibilities that evolved with the emergence of DVAs may boost when other ideas like the "wisdom of things and the semantic web mature" and achieve their complete capabilities (Kar & Haldar, 2016).

Kathy Hirsch-Pasek, who is a psychology professor at Temple University in Philadelphia, expressed that a partnership between IBM and Sesame Street may result in the development of software and devices fit for reacting in manners that are "socially responsive" to learners' language and activities (Herold, 2016).

Bozkurt and Goksel (2018) suggested that various forms of DVAs can be leveraged and integrated into multiple parts of the instructing and learning process. Amazon recently developed the Skill Blueprint, which allows educators to create skills, mini-apps for their classrooms without prior coding knowledge. With these skills, Amazon Alexa could serve as a new voice in the classroom by stating facts, telling stories, and presenting a new perspective (Machajewski, 2018). One obligation of a teacher is to make essential learning encounters that actuate and challenge thinking to blend excitement for the learning point or curriculum standard. Learning as a whole is the consequence of an inquisitive mind that is eager to examine an issue, follow up through reading, posing inquiries, and imparting to other people. Unquestionably, creating a

learning environment that allows students to learn how to use voice assistants, creates these new learning experiences (Machajewski, 2018).

Consequences of Digital Voice Assistants

The use of DVAs faces many criticisms as a consumer product. Dale (2015) suggested that DVAs are an overlay or a shortcut to do online searches. Wiederhold (2018) stated that, with adequate safety policies in place, enhanced privacy legislation, and increased public acceptance, it is reasonable that future DVAs will reflect all capabilities of previous predecessors in all aspects. After all, the growing use of digital media offers considerable advantages through premature teaching, the satisfaction of a child's interest, and even the promotion of healthier coping skills. For instance, if a student shows sadness to the use of Alexa, the AI provides a favorable reaction based on solutions, Alexa might state, "I'm happy to know that." It may assist in talking to a colleague, listening to songs, or taking a stroll. DVAs are vulnerable and are susceptible to threats such as hacking and constant audio surveillance, which raises privacy concerns as it relates to Family Educational Rights and Privacy Act (Davie & Hilber, 2018; FERPA, 2018; Hoy, 2018).

Nevertheless, Wiederhold (2018) suggested considering some aspects of AI when searching for tools to use in the child development process. Users are required to place a lot of confidence and emphasis and accentuation in tech companies and their abilities to develop meaningful learning resources, backed by research with learners' interactions in mind. Reid Chassiakos et al. (2016) suggested that only a few of the publicly available applications (apps) discovered in the instructional segment of application stores had

significant evidence to support the design and overall effectiveness towards learning outcomes but rather concentrating on rote academic abilities (memorization of picture-word association, numbers) instead of focusing on existing core curriculum materials and or instructions. While considering a universe where Alexa can assist a learner to enhance their learning, and linguistic abilities are tantalizing, the reality continues that AI does not substitute the personal input of a teacher.

Stucke and Ezrachi, (2018) suggested one technology that is no doubt on the increase of popularity in performing ordinary household tasks such as adjusting the light brightness, room temperature, and even adjusting audio volume, is the digital assistant. One may quickly gravitate towards relying on it (the digital assistant) for other basic tasks such as changing the channel on the television or shopping. This level of voice interaction between humans and DVAs requires the collection of information that could potentially pose a threat to consumers as it relates to privacy concerns.

Additionally, Lang and Benessere, (2018) added that when one interacts with Alexa, the Echo streams sound to the cloud. Amazon's conditions for the Echo appropriately tell clients that "Alexa processes and retains your Alexa Interactions, such as your voice inputs, music playlists, and your Alexa to-do and shopping lists, in the cloud to provide and improve our services" (Amazon, 2017). The storage space of Alexa's raised a plethora of concerns around privacy and security.

Pfeifle (2018) noted that specialists added that both Amazon's stockpiling of discussions and the connecting of those discussions to clients as security worries that Amazon ought to have thoroughly considered before releasing Alexa to the general

population. A subsequent concern noted by specialists is the innovation creators' absence of straightforwardness and the lack of transparency regarding the usage of data on individuals' interaction with DVAs and how these interactions may raise privacy concerns. Organizations should educate clients concerning the necessities for, and revelation of, their information used on these AI-infused innovations.

Pfeifle (2018) also suggested that, with the rapid paradigm shifts, federal laws and jurisprudence are undoubtedly playing "keep up." Despite the quick responses of state legislatures, more rapidly than the courts or Congress, the efforts by legislatures have been proven to be futile. Therefore, a two-pronged approach would be useful, where companies may incorporate privacy in the engineering of their devices, thus providing the platform for legislatures to create a law to ensure that the confidentiality of its consumers is maintained and secure before the devices are released and sold in mass markets.

Summary and Conclusions

DVAs have the potential to be a game-changer and revolutionize how learners' access, interact, process, and use data in the education industry. Consumers believe and depend on DVAs for significant daily advantages. DVAs will also no longer only make cold brew latte and switch lights on in various rooms at a command. DVAs can tutor kids, provide amusement in homes, globalize storytelling, buy meals, recommend movies, and call on the self-driving car to take individuals on their commute. AI in teaching and learning has been a significant move towards ensuring that every pupil gets the content they need to accomplish educational objectives and learning outcomes. Nevertheless, it is not enough to cultivate complete engagement with each learner. This is

where the next stage is individually tailored instruction. These innovations advance the student-centered approach to another level. It extends even further than merely answering student demands. Alternatively, learners get involved throughout the process of identifying educational objectives, pedagogy, and teaching methods. It did not appear to be possible until lately to satisfy learners' requirements and needs in this manner. To personalize teaching for 20 to 30 learners, track students' progress, and provide constructive criticism is very time-consuming and can be improved through the use of technology.

This situation differs from many other employment fields in danger of automation due to the distinctive requirements imposed on primary and secondary educators. A successful teacher should always try to teach each student in their classrooms in a manner that is conducive to that learner's uniqueness and learning style(s). Some learners may also have issues with their behavior or other psychological issues that prevent or cripple the teaching and learning process. As well as, these students may have family members' that can be too engaged in their education that limits their independence or relatives who are not sufficiently involved in the learning process. An efficient educator should traverse all these challenges, and while the instructional curriculum requirements often change.

Finally, it requires educators to be empathic, rigid, and organized at a virtually stellar level. It could be challenging to establish autonomous educators who can fulfill all the above needs, but would enhance AI innovations address our most general and global educational problems? Now the massive amount of information required for more individualized instructions can be synthesized by AI. It can build the context, bring into

account students' learning requirements and aspirations, define learning deficiency and needs, and create and deliver the route to achieve these objectives in the finest possible way. Even though the sample used in this study was small, the results are transferable to similar educational settings and contexts. As such, the results presented in the study may not fill the gap in the literature. However, the results introduced may fill a gap in further practice regarding the use of DVAs in education or other settings. Chapter 3 presents a discussion of the participants' selection, instrumentation, methodology, trustworthiness, and ethical procedures used in the study.

Chapter 3: Research Method

The purpose of this qualitative study was to identify teachers' perceptions, knowledge, and strategies employed among SPED teachers using DVAs to differentiate instruction in their classrooms. In this study, I sought to establish a foundation on which policies and guidance can be developed and implemented within the local context. Understanding the usage of these technologies in the classroom may offer teachers information regarding the benefits and or limitations that DVAs have on pedagogy. Additionally, in this study, I investigated how the utilization of AI (DVAs) in middle school classrooms can reinforce cognitive, language and communication, and social and physical learning experiences for students. The problem that I investigated this study was, despite the emergence of DVAs as tools for instructions, teachers lack knowledge and strategies for using DVAs to differentiate instruction in their classroom. The local district requires policies and guidance on how DVAs can or should be applied. To address the problem in this study, I used a basic qualitative approach to determine how DVAs can or cannot support and differentiate learning.

For this section, I discussed critical elements relating to the research methods used to achieve this study. These fundamental elements include research design, researcher's role, methodology, participants selection, instrumentation, data collection, data analysis, trustworthiness, and ethical procedures. A summary of these elements concludes this chapter.

Research Design and Rationale

Qualitative research is focused more on process than outcomes; this type of research focuses on understanding how people assimilate and adjust to their lives and experiences (Creswell & Creswell, 2017). To address the problem in this study, I used a basic qualitative approach to determine how AI DVAs can or cannot support and differentiate learning in SPED classrooms (Merriam & Tisdell, 2016). Also, I provided data to answer the three research questions guiding this study:

1. RQ1 - What are the perceived challenges faced by middle school SPED teachers using DVAs in differentiating instructions in SPED classrooms?
2. RQ2 - What resources and strategies are known to be available to prepare middle school SPED teachers for differentiating instructions in SPED classrooms using DVAs?
3. RQ3 - What is the perceived knowledge of middle school SPED teachers related to the usage of DVAs to differentiate instructions in the classroom?

In this basic qualitative study, I explored teachers' perceptions of using AI, specifically DVAs in SPED classrooms, to differentiate instruction to meet the needs of diverse learners. Moreover, this study examined the participants' perceptions to determine themes, relationships, and meanings as it relates to incorporating AI technologies as a means of differentiation. Merriam and Tisdell (2016) characterized research in education as a basic qualitative research.

Most qualitative research requires a narrative, whether case study, phenomenology, and grounded theory (Mertler, 2016). These research narratives include

explorations that are in-depth of multiple participants to gain insights into their experiences and how participants associate meanings to these lived experiences (Mertler, 2016). Mertler (2016) postulated that phenomenological studies require an in-depth analysis of the lived experiences of at least five to 25 participants. I went on to suggest that ethnographic studies encompass the researcher immersing and fully interacting with a particular group of people to understand the phenomenon of interest thoroughly. Additionally, these types of qualitative studies, phenomenology, case study, and ethnography require extensive time to collect data and analyze data to generate a theory (Mertler, 2016).

A narrative-based research design was not suitable for this study, as I have interviewed six participants. Moreover, a case study was not suitable for this research, as there is a single unit of analysis (Leedy & Ormrod, 2016). Furthermore, if an expert's essential interest is on uncovering opinions, assessments, frames of mind, or thoughts regarding things, and there are convincing explanations behind the examination, those points of convictions, and feelings. Researchers can gather these types of data via quantitative survey research with an instrument that has distributed proof of its legitimacy and unwavering quality. Additionally, in contrast to quantitative research, which depends on specific narrow questions and the analysis of numbers, qualitative research focuses on broader open-ended questions. Whereas quantitative research aims to test the general laws of behavior, phenomenon, or theory, qualitative research seeks to understand the societal reality of an individual or group close to how the participants lived or experienced the phenomenon (Denzin & Lincoln, 1994).

Merriam and Tisdell (2016) suggested that a basic qualitative study is inherently contextual, objectively explanatory, and beneficial in fostering a common knowledge of a subject or circumstance. Percy et al. (2015) suggested that a basic qualitative research, however, is beneficial whenever a researcher seeks to address real challenges in everyday life from a research participant's point of view (for example, values, behaviors, and perspectives). However, the researcher is not concerned about the participant''s experiences nor a specific unit for analysis, as with a phenomenology or case study, respectively. Merriam and Tisdell (2016); Merriam, and Grenier, (2019) suggested that a basic qualitative research design will not concentrate exclusively on convictions, conclusions, or thoughts regarding things. Beliefs and viewpoints may rise as a feature of one's discoveries yet ought not to be the reason for directing a basic qualitative research plan. A qualitative study is a perfect technique when an all-encompassing, top to bottom examination is required (Feagin, Orum, & Sjoberg, 1991). Qualitative research is more centered around procedure than results; this sort of research centers around seeing how individuals absorb and conform to their lives and encounters (Creswell and Creswell, 2017).

Merriam and Tisdell (2016), and Merriam, and Grenier, (2019), suggested that a basic qualitative research as having been derived rationally from constructionism, phenomenology, and emblematic association and as being utilized by scientists who are keen on "(1) how people interpret their experiences, (2) how they construct their worlds, and (3) what meaning they attribute to their experiences. The overall purpose is to understand how people make sense of their lives and their experiences" (p. 23). In the

long run, the reason for an educational qualitative study is to improve our training, and the essential qualitative research configuration is especially appropriate to get an in-depth comprehension of robust instructive procedures (Merriam & Tisdell, 2016). An example of this is using a simple qualitative study to uncover the skills, scheme, and practices of effective teachers and administrators. This nature of findings is not possible with quantitative approaches.

Pioneers of the methodology, such as Stake (1995) and Yin (2018), who has extensively worked with this methodology and research design, developed robust procedures for researchers to follow. These strategies are well developed and tested. Despite whether the research is a quasi or a full experiment, the information gathering, and investigation procedures may hide a couple of nuances (Stake, 1995). On the other hand, a basic qualitative study draws out the nuances from the perspective of the participants by utilizing numerous data sources. Creswell (2013) characterized a qualitative as a comprehensive approach to gathering data that is delimited.

A basic qualitative study seeks to understand complex systemic interactions as well as individual perceptions as it relates to a phenomenon or unique experiences (Bender & Hill, 2016). The basic qualitative study design focuses on understanding how teachers use DVAs to differentiate instructions in SPED classrooms. This strategy for research is both inductive and adaptable, taking into consideration an all-encompassing methodology that encourages a rich comprehension of the phenomenon examined. For this study, a basic qualitative design is best suited, as this design aligned with this study's

problem, purpose statement, and research questions, and it is best suited to address the problem and research questions of this study.

Role of the Researcher

According to Merriam (2009), the researcher is the primary instrument for data collection and analysis. For this study, I served as an objective interviewer seeking to understand SPED teachers' perceptions and use of DVAs in instruction. Currently, I am employed with the school district as a business and technology teacher at one of the high schools. At the local district, the technology department is responsible for implementing new technologies. However, with the BYOD policy and limited resources, teachers' use whatever technologies are available to them to engage students and differentiate instructions. I am not responsible or involved in deploying any technology district-wide. Since I conducted the study at the middle school level, I had little to no working or outside relationship with SPED teachers across the district. Since there are little to no associations between the teachers participated in the study and me, the opportunity for bias was reduced, which afforded credibility and reliability in the data.

The researcher plays a vital role in qualitative research (Ravitch & Carl, 2016). Ravitch and Carl (2016) added that "positionality" as the job of the researcher and way of life as they meet and structure a relationship to the specific situation and setting of the exploration. Additionally, the quality of the experience as the researcher tries to describe or understand human experiences are essential in presenting quality data. Furthermore, qualitative researchers develop a comprehensive understanding of a phenomenon using exploration, description, and interpretation.

The researcher's role plays a pivotal role in understanding the improvement, plan, approach, and information gathering methodology for this investigation. I contacted and got consent from the school district and the governing body. I contacted the selected teachers to participate in the interview for data collection also to receive approval and confirmation of their participation in the semistructured interview for data collection. I scheduled and facilitated the interviews. Additionally, I kept a journal to record reactions as well as reflections throughout the research and data collection process. I used the journal entries to identify and record experiences, perceptions, biases, and assumptions to enhance the overall quality of the data that is collected.

Methodology

This basic qualitative study utilized in-depth interviews to gather data for analysis. Qualitative research provides the researcher with the opportunity to document the perceptions of participants within a study (Yates & Leggett, 2016). Yates and Leggett (2016) suggested that a qualitative study highlights the why and how of a story. For this section, I discussed elements pertinent to determining appropriate data sources, instruments used to collect data, and suitable data analysis methods.

Participant Selection

To select participants for the study, I used purposeful sampling. This method of participant selection meticulously selects participants to garner a better understanding of the phenomenon (DVAs) used to differentiate instructions in SPED classrooms (Morse, 2015). The participants chosen for this study are middle school SPED teachers in the school district in the southeastern state, using the DVAs in their classrooms.

I contacted a selected sample of 10 to 12 SPED teachers to participate in the study; however, six teachers ultimately engaged in face-to-face or virtual semistructured interviews to collect data on their perceptions of the use of DVAs in instructions. Also, to explore how they planned and incorporated this innovation to individualize instructions and cater to the needs of unique learners. Since I conducted the study in a rural school district, there were three middle schools with a total of 18 SPED teachers. I limited the study to the middle school level and SPED teachers, and any further limitation may hinder or affect the number of participants in the study. Since the available pool of eligible teachers to participate in the study was small, it was only realistic that I recruit an acceptable amount of 10 to 12 participants to participate in the study. Francis et al. (2010) postulated that a minimum of 10 participants is required to reach data saturation in a study by researchers. If I did not achieve the desired 10 to 12 participants, in the social sciences, a 30% participation rate is considered high from a pool of eligible participants (Guest, Bunce, & Johnson, 2006). For this study, data saturation took place at 33% of the potential participants.

Instrumentation

The interview is the essential wellspring of information for this qualitative research. All the different aspects of the interview are circumspectly visited, from the earliest starting point to the last interview transcription. Rubin and Rubin (2011) expressed that qualitative interviews resemble night goggles, allowing us to analyze what researchers look at but seldomly see (Rubin and Rubin, 2011).

Interviews are the most regularly utilized technique for information gathering in qualitative research. Patton (2015) mentioned the “interview guide approach.” This approach highlights issues and topics before the interview, even though the interviewer decides on the flow pattern and wording during the interview. This outline provides a somewhat systematic method of collecting data for each respondent, providing an opportunity to foresee gaps and close them while maintaining balance, ensuring that it is still somehow “conversational” and “situational.” The flexibility of this method paves the way for a change in sequencing and format of questions, which may result in different responses from interviewees reducing the ability to compare several responses.

Semistructured interviews are the primary instruments used for collecting data in this study. The semistructured interviews comprised of questions that are open-ended. Open-ended questions allow participants of the study to provide their experiences and perceptions of the phenomenon without constraints (Morse, 2015). Open-ended questions allow the participants to frame open-ended responses and provide the researcher with a more in-depth analysis of the phenomenon during the interview process (Morse, 2015).

Merriam and Tisdell (2016) suggested that a semistructured approach as a possibility for the qualitative interview. Therefore, having a mix of open-ended questions and structured questions should be meticulously selected as they are the windows that lead to a world of data.

The semistructured interviews consist of 23 questions derived from the three research questions (Appendix C).

1. RQ1 – What are the perceived challenges faced by middle school SPED teachers using DVAs in differentiating instructions in SPED classrooms?
2. RQ2 – What resources and strategies are known to be available to prepare middle school SPED teachers for differentiating instructions in SPED classrooms using DVAs?
3. RQ3 – What is the perceived knowledge of middle school SPED teachers related to the usage of DVAs to differentiate instructions in the classroom?

Table 1

Research Questions and Interview Question Alignment

Research questions	Interview questions
Questions about the teacher	A. How long have you been teaching? Have you always been a SPED teacher? How many years as a SPED teacher? B. Do you have a paraprofessional in your classroom? If so, what is their role in the classroom?
Questions about SPED/Differentiation/Their students	C. Describe your (SPED) students (quantity, grades, subjects, learning issues, etc.) D. What is your definition of differentiated instructions? i. What strategies come to mind when you hear the term differentiated instruction? ii. How do you differentiate for students in your classroom? Give examples.
Questions about the technology and other instructional materials/tools available to the teacher	E. How do you or school leaders go about selecting, evaluating, and determining appropriate instructional materials and or assistive technologies for the differentiation process? F. What kind of technological resources do the students in your classroom have access to?
Questions about the impact of using DVAs	G. Describe your level of access to DVAs in your classroom?

	i. Which DVAs do you have access to? ii. How has the DVA impacted your ability to deliver instruction to your students? iii. How would you describe the engagement and learning outcomes of students after using DVAs to differentiate instructions?
RQ1- What are the perceived challenges faced by middle school SPED teachers using DVAs in differentiating instructions in SPED classrooms?	H. What are some of the challenges, if any, you have faced when planning and implementing DVAs to differentiate instructions? i. Describe how the use of AI/DVAs made it easier or more difficult for you to differentiate instructions? Please explain. ii. Are privacy issues a concern as it relates to the implementation and use of DVAs in your content area?
RQ2 - What resources and strategies are known to be available to prepare middle school SPED teachers for differentiating instructions in SPED classrooms using DVAs?	I. How much training have you received using Digital voice assistant for instructions? i. How are you/teachers being trained on how to use and incorporate the new DVA to provide differentiated instruction to students? ii. How could teachers be better prepared to meet the challenges of using DVAs?

	J. What is your level of involvement in the selection of the technologies used in the teaching and learning process?
RQ3 - What is the perceived knowledge of middle school SPED teachers related to the usage of DVAs to differentiate instructions in the classroom?	K. How does your technological knowledge influence your selection and use of technology to differentiate instructions in your classroom? L. How does your pedagogical knowledge influence your selection and use of technology to differentiate instructions in your classroom? M. How does your content knowledge influence your selection and use of technology to differentiate instructions in your classroom? N. What have you learned about using DVAs that can help you be successful in differentiating instruction?

Procedures for Recruitment, Participation, and Data Collection

As soon as I received the Institutional Review Board's (IRB's) approval (01-30-20-0705456), I began recruiting participants for this study. Recruitment of participants was done through emails since I am an educator within the school district, I have access to teachers, principals, and other stakeholders email addresses through schools' websites, teacher portals, and Outlook address book. To encourage and engage participants to participate in the study, I drafted brief emails that are to the point, to spark teachers' interest and reduce reading time. Additionally, I attached an informed consent (Appendix B) to the participants' invitation emails outlining the purpose and the scope of the study.

The informed consent also contained my contact information, which includes my email address, as well as my cell phone number, in case potential participants have clarifying questions before, during, or after participating in the study.

I sent invitations to all middle school SPED teachers within the district, with the expectation that at least ten to twelve participants would accept the invitation to participate in the study. After a week, I followed up with invited teachers to ensure I had the intended ten to twelve participants; however, nine teachers indicated an interest in the but only six teachers participated in the study. I advised invited participants that there is no compensation for participating in the study, and his or her participation was entirely voluntary. Therefore, he or she will be free to refuse participation at any time. Once invited participants accepted the information outlined in the informed consent and express willingness to participate in the study, I contacted participants by telephone or email for screening to ensure they met the criteria of the study. For potential participants that met the requirements, I scheduled a date and time for a face-to-face or virtual interview, whichever is most convenient to the participant.

Data Collection

I requested and sought authorization from the Superintendent of the school district in the southeastern state (Appendix A), principal, and teachers; then, interviewed participating SPED teachers to ascertain data on their experiences and perceptions of using DVAs to differentiate instructions. I collected data from semistructured interviews, either face-to-face and virtual. The interviews were recorded and transcribed using the Otter app.

In this study, I used interviews with SPED teachers to gauge their perspective on the use of DVAs in their instructions. Interviews enable the researcher and subjects to dig deeper and uncover a more personal and descriptive understanding of the phenomenon investigated that may not be identified easily from observations (Creswell, 2008). These were semistructured interviews that were face-to-face and virtual for participants' convenience.

Moreover, semistructured interviews enable the researcher to adjust his or her mode of operation and the sequencing of questions asked to evoke more authentic responses from the subject through personal discussions (Ravitch & Carl, 2016). In particular, semistructured interviews empower interviewees to give answers comfortably; on their very own terms. Semistructured interviews yield compelling insights into understanding how interviewees perceive the phenomenon/innovation that is currently being studied (Rubin & Rubin, 2011). In a basic qualitative study, the interview process is fundamental. The interview fills the specific need of investigating and assembling experiential narratives and anecdotes, that are essential to developing a more comprehensive analysis of the phenomenon in question (DVAs) (Van Manen, 2014; Van Manen, 2017).

Data Analysis Plan

I utilized the in-depth interview design for data analysis purported by Moustakas (1994) to identify emerging themes from participants' discussions from the semistructured interviews. The guiding research questions asked middle school SPED teachers perceived challenges faced with differentiating instructions with DVAs, the

known resources and strategies for differentiating instructions in their content area, and the perceived knowledge teachers have of differentiating instructions using DVAs. I used Tomlinson's (2014) four attributes that influence differentiating instructions (content, process, product, and learning environment) and TPACK's three fundamental types of knowledge (technological, pedagogical, and content) to inform the research and interview questions.

I first perused the transcriptions from the interviews using the basic qualitative method (Creswell, 2013). At this phase, I annotated and made memos within the transcripts to generalize the data from the interviews. To assist with understanding the data gathered in this study, and sensibly presented them, I coded the data using two-cycle coding. In the first cycle of coding, I utilized the initial coding strategy and used the axial coding strategy for the second cycle of coding (Saldaña, 2009).

Saldaña (2009) classified initial coding as open coding, which is an essential process for exploring and comparing data by developing a coding scheme applied to the data. The initial coding process allows researchers to become acquainted with the data in a study (Saldaña, 2009). Saldaña (2009) suggested that during the initial or open coding process, the researcher reduces the data to distinct and meaningful units about the data. I identified the emerging codes by using words, phrases, or sentences.

The second phase of coding used axial coding. Axial coding comprises of recognizing connections between the open codes (Saldaña, 2009). The codes highlighted in the initial coding process often become a significant category in the axial coding process (Leedy & Ormrod, 2016). The categories then formed themes that highlight

patterns to help understand the data in the study (Merriam & Tisdell, 2016; Saldaña, 2009). The process of continuously reviewing the information, redesigning themes and categories to analyze data is empirical and is used to compose an enormous amount of information in a meaningful way that gives an understanding of the subject the researcher is studying (Percy et al., 2015).

After recognizing the significant statements from interviews, I began coding the data (Charmaz, 2014; Creswell, 2013). For data analysis, I assigned codes to the significant statements identified in the annotation process of the transcripts. I then transferred the data into NVivo 12 qualitative data management software to facilitate coding and analysis.

Trustworthiness

Trustworthiness or meticulousness of an investigation alludes to the degree of trust in information, elucidation, and methods utilized to guarantee the nature of the study (Polit & Beck, 2014). King, Horrocks, and Brooks (2018) suggested that the trustworthiness of a qualitative research study depends on its reliability and validity. Credibility, dependability, transferability, and confirmability are criteria that researchers can use to evaluate the quality of qualitative research. Capitalize on or testing the trustworthiness of qualitative research elevates the credibility and dependability of the results (King et al., 2018). In this study, I provided procedures and protocols noteworthy for consideration by the participants (Amankwaa, 2016).

Credibility

In qualitative research, trustworthiness results from credibility. The credibility of a study refers to the confidence in the truthfulness and findings of a study. Credibility is an essential criterion in qualitative research (Polit & Beck, 2014). Using credibility, researchers can evaluate the truth value or validity (Hammarberg, Kirkman, & de Lacey, 2016). A qualitative research study is credible when the findings and interpretations are plausible to the participants. To accomplish credibility in this study, I conducted a member checking with participants in the research to peruse codings, transcripts, and summaries to guarantee accuracy (Polit & Beck, 2014). I allowed participants to review the transcripts from their interviews and made any necessary adjustments as needed. Additionally, conducting a member check allowed participants to review the initial findings of the study to guarantee the accuracy of my data interpretations. I established credibility by making the necessary corrections or adjustments based on feedback provided by participants in the member check.

I also had an independent colleague who is the principal in another school district, holds a Ph.D. in leadership and administration and has no affiliation to the study settings and participants to review the data and findings for alternatives viewpoints and to reduce bias. A qualitative study is credible when its results, presented with adequate descriptions of context, are recognizable to people who share the experience and those who care for or treat them (Merriam & Tisdell, 2016; Mertler, 2016).

Dependability

Trustworthiness alludes to the dependability of the information gathered from the instrument utilized for the accumulation of data (Polit & Beck, 2014). Also, dependability is closely related to reliability in quantitative research. King et al. (2018) suggest that inquiry audits enhance the dependability in a qualitative study as this will effectively examine the process and the product for consistency. An inquiry audit is a record that incorporates crude information, documentation of procedure and results of information decrease, investigation, and combination; methodological procedure notes; reflective notes; and instrument advancement/directing strategies (King et al., 2018).

Dikko (2016) described a pilot test as a process of running a sample testing of interview questions with subjects other than the participants of the study. This trial study ensures that the instructions to actual participants are clear and test interview questions for clarity, for participants' openness and honest responses during the study (Dikko, 2016). Additionally, a pilot test of the study accounts for smooth delivery and interactions during the interview process. To ensure dependability throughout this study, I conducted a pilot test with five (5) subjects exclusive of the study. The final research did not include responses from participants in the pilot test, but to test for skewness in the interview questions.

Transferability

The possibility of transferability alludes to how much the discoveries of an examination are profitable to individuals in various settings (Polit & Beck, 2014). The readers will decide how pertinent the findings in the study are to their circumstances

(Polit & Beck, 2014). To achieve transferability, I reinforced and used thick description throughout the study with a reasonable, positive depiction of the specific situation, area, and participants contemplated, and by being clear about the purpose and analysis of the study (Amankwaa, 2016). The use of thick description will supply future researchers with adequate detailed descriptions for them to make their determination as to how and where this study will apply in their studies (Merriam & Tisdell, 2016).

Confirmability

Confirmability in a study refers to the objectivity of the study and to the extent to which others can corroborate the results presented in the study (Trochim & Donnelly, 2008). Since a qualitative study is inherently subjective of the participating group studied, supplying a point by point depiction of the data collection instruments utilized for data analysis can aid in improving confirmability (Trochim & Donnelly, 2008). To ensure confirmability throughout this study, I used an audit trail or data audit that included detailed descriptions of the data collection process and data analysis procedures to make a judgment on potential biases. I used a journal to document the process of data collection and coding process as well as for notes in interviews.

Ethical Procedures

Before conducting the research, I contacted the Superintendent (Appendix A). I received the approval of the Superintendent of the school district where the study took place and presented it to the principals of study sites. I sought support from the IRB, after receiving IRB's approval (01-30-20-0705456); I presented the IRB's approval to Superintendent, as the district's approval was contingent upon the IRB's approval.

Additionally, Willis, Jost, and Nilakanta (2007) and Ravitch and Carl (2016) purported that ethical guidelines mandate that the researcher must receive informed consent from all individuals participating in the study. The informed consent should not only require the participant's signature and consent to participate in the study but also outline the purpose and intended goal of the research for participants to make a decision (Willis et al., 2007). Participation in this study is entirely voluntary, and I informed participants that they could withdraw at any time during the study if they wish to without penalty or fear of any consequences. Also, I assured participants of anonymity; instead of names or any suggestive identifiers, I used pseudonyms to distinguish participants.

Creswell (2008) implored researchers that "participant confidentiality is of the utmost importance" in qualitative studies. To ensure confidentiality, I informed participants of their confidentiality in the informed consent (Appendix B) and verbally before the start of the interview process. I did not associate any informed consent with interview transcripts, and interview transcripts had pseudonyms instead of participants' names. Additionally, I stored all research data in a secured location, which will remain stored for five years after the completion of this study. After this time has passed, I will destroy the data, which includes but not limited to informed consent, transcripts from the interviews, and recordings as stipulated in the guidelines of media sanitization (Kissel, R., Regenscheid, Scholl, & Stine, 2014).

Summary

A qualitative study aims at exploring circumstances in the real world from a personal, conceptual stage. I used a basic qualitative design to explore middle school SPED teachers' perspectives, possibilities, and potholes of utilizing DVAs to differentiate instructions. This chapter outlines the methodology and procedures used in the research. With the differentiation and TPACK framework, I developed semistructured interview questions to investigate participants' perspectives.

I discussed the findings of the data gathered in Chapter 4. The data collection process is included in Chapter 4 and expands data analysis utilizing the software NVivo12. The information collected is explained and discussed in Chapter 4.

Chapter 4: Results

Introduction

The purpose of this qualitative study was to identify teachers' perceptions, knowledge, and strategies employed among SPED teachers using DVAs to differentiate instruction in their classrooms. I conducted this study to establish a foundation on which policies and guidance can be developed and implemented within the local context. To address the problem in this study, I used a basic qualitative study to determine how AI DVAs can or cannot support and differentiate learning in SPED classrooms. I used the following three research questions to guide this study:

1. RQ1 - What are the perceived challenges faced by middle school SPED teachers using DVAs in differentiating instructions in SPED classrooms?
2. RQ2 - What resources and strategies are known to be available to prepare middle school SPED teachers for differentiating instructions in SPED classrooms using DVAs?
3. RQ3 - What is the perceived knowledge of middle school SPED teachers related to the usage of DVAs to differentiate instructions in the classroom?

A list of all themes and subthemes is provided in (Appendix E). This chapter provides details about the setting, data collection, data analysis, results, and evidence of the trustworthiness of this research.

Setting

The setting for this study was a small rural, Title I school district in a southeastern state. The local school district comprises 14 schools, which include three elementary,

three primary, two middle, one middle-high, two high, and three vocational schools. At the time of this study, the total student enrollment in the school district was 4,578. Of the total number of students enrolled in the school district, 746 had an IEP with specialized services in a SPED classroom. Throughout the data collection process, no individual or institutional factors at the research location were identified, which may have altered the participants' responses and or the participants' perceptions and therefore impaired the analysis of the findings of this study.

Demographics

To gain background information on the participants and the student population that they teach, I asked participants to share their years of experience as a teacher, years teaching in the SPED content area, as well as to describe their students. Participants share their overall years teaching, ranged from 1 year and 6 months to 20 years, and teaching within the SPED classroom varied from 1 year and 6 months to 16 years. P1, P2, P3, P5, and P6 shared they work as resource SPED teachers, which means they provide support to students who are higher functioning but have learning challenges or an Individualized Education Program (IEP). P4 works within a self-contained classroom setting where students are low functioning or with physical challenges.

Table 2

Research Participant Demographics

Participant	SPED specialization	# Yrs Teaching	# Yrs in SPED
P1	Resource	1.5	1.5
P2	Resource	25	9
P3	Resource	20	9
P4	Self-contained	17	16
P5	Resource	8	3
P6	Resource	17	4

Data Collection

The data collected in this study came from SPED teachers using semistructured face-to-face and virtual interviews. I originally intended to collect data from at least ten participants. After receiving approval from the partnered school district and IRB's approval (01-30-20-0705456), I sent out an email to SPED teachers in the district; nine teachers met the criteria for the study and showed interest in participating in the interview process. However, on the closing day of the participation window, only six participants responded and consented for an interview. Three potential participants indicated when contacted to schedule an interview that they were no longer interested in participating in the study. Initially, all six participants scheduled face-to-face interviews; however, for convenience, four participants rescheduled virtual interviews, and two participants participated in face-to-face interviews.

The interviews took place between February 04, 2020, and February 18, 2020. I reminded participants of the voluntary nature of their participation at the beginning of each interview and reassured confidentiality and anonymity. The face-to-face interviews lasted between 25 and 40 minutes, while the virtual interviews lasted between 23 and 30 minutes. I used the Otter app equipped with AI technology to record and simultaneously transcribe interviews. For the face-to-face interviews, I used my iPad pro with the Otter app installed to record and transcribe the interviews. However, for the virtual interviews, I used Facetime or Zoom on my iPad pro for loud, crisp, and clear sound quality and recorded and transcribed on a cell phone with the Otter app installed. After the Otter app processed and finalized the interview transcription, I replayed and manually went through the transcription line by line to check for errors and fix mismatched words and phrases. I performed member checking by providing the completed transcriptions to the participants for verification and check for accuracy and an accurate representation of their perspectives.

Data Analysis

The guiding research questions asked middle school SPED teachers perceived challenges faced with differentiating instructions with DVAs, the known resources and strategies for differentiating instructions in their content area, and the perceived knowledge teachers have of differentiating instructions using DVAs. I answered these research questions using open-ended interview questions that probed SPED teachers' experiences and knowledge of differentiation using various technologies inclusive of DVAs.

I used Tomlinson's (2014) four attributes that influence differentiating instructions (content, process, product, and learning environment) and TPACK's three fundamental types of knowledge (technological, pedagogical, and content) to inform the research and interview questions. After participants completed member checking for accuracy, I uploaded the transcripts to the NVivo 12 software and began the open coding process. During the open coding process, I highlighted significant words and phrases to form codes. From the open coding process, I generated a total of 102 codes. After I identified these, I used axial coding to organize these codes into 14 categories which eventually became subthemes of the five overarching themes that I identified within the data.

Table 3

Table Showing List of Themes and Subthemes

Themes	Subthemes
1. Differentiating in SPED content	*1a) Types of Learners* *1b) Individual Needs* *1c) Strategies for Differentiation*
2. Selecting Appropriate Technology	*2a) Available Technology* *2b) Teachers' Selecting Technology*
3. DVAs in Action	*3a) DVA Uses in the Classroom* *3b) Impact on Learning and Engagement* *3c) Potholes with DVAs* *3d) DVA Take-Aways*
4. TPACK and Differentiation	*4a) Technological Differentiation* *4b) Pedagogical Differentiation* *4c) Content Differentiation*
	5a) Self Taught

Results

I organized the results presented in this section by the five overarching themes and subthemes generated during the data analysis process. I asked participants several questions to gain their perspectives on the use of DVAs in their content area. I assigned participants alphanumeric codes for anonymity. Discussed in this section are the five major themes supported by the subthemes.

Theme 1: Differentiating in SPED Content

I asked the participants to share what comes to mind or their definition and understanding of the term differentiation. P1 defined differentiation as "DI means that I try to reach all my students because they are on different levels, which means that I find different strategies to teach my kids that are performing on very different grade levels." P2 suggested, "think of different, so instruction is different for everyone." P3 shared that "DI is dependent upon the students' need, each individual need because every student has their own learning style." P4 suggested that DI means "being able to disseminate instruction in such a way that it caters to all the students, their learning styles, their abilities, and basically the speed at which they are able to gather and comprehend whatever is in taught." P5 indicated that DI "is allowing all students access to the curriculum, but at the same time, you are breaking it down to ensure that you are meeting

them at their level." Finally, P6 suggested differentiation is "meeting the student where they are."

Participants' definitions align with findings in the literature. Instructions should include materials that interest the learners and spark their enthusiasm, to create better specific gifts and learning outcomes (Khan et al., 2017). Tomlinson (2014) postulated that differentiating instructions implies giving learners a variety of options for learning. This method of teaching suggests that teachers observe and comprehend the distinctions and similarities among learners and utilize this data to design individualized instructions tailored to learners' needs.

Subtheme 1a: Types of Learners. Participants' responses from the interview indicated that differentiation is dependent on the types of learners in the classroom. They shared that the kinds of learners they interact with include but are not limited to students with mental and physical disabilities, audiovisual learners, learners with ADHD, auditory learners, kinesthetic, and learners with autism. P1 stated that for audio learners, "I always try to use some form of audio recording to reach them." P2 responded that "my autistic children do wonderful with technology, turn them loose and tell them to do a research and they'll come up with so much research, they're on the higher spectrum, you know, they'll come up with so much research until it blows your mind." Also, P2 stated that "ADHD children are better with paper and pencil because when they're on that computer, they could be on that test, but they may be on something completely different."

Subtheme 1b: Individual Needs. Participants' responses from the interview indicated that differentiation is dependent on individual student's learning needs. P1

suggested, “I have to find strategies and methodologies to cater to each student to ensure that they’re able to master grade-level standards.” Selecting content, materials, and technologies based on learning needs is essential, “there are no two people alike, some may learn in similar fashions, but you have to make provisions for all of the students.” The learning needs of students vary; higher functioning learners can handle large chunks of content at once; however, learners who are lower functioning may require small pockets of content, then progress steadily until complete. For example, P2 shared, “when taking quizzes, some students need for me to give them five questions, and when they’re done with those five, give them the next five or ten questions.”

The descriptions participants identified of their students’ learning needs are supported by Ness (2016), who recommended that middle-level students need learning instructions differentiated that cater to their unique learning needs.

Subtheme 1c: Strategies for Differentiation. Participants’ responses from the interview indicated strategies used to differentiate instructions to cater to the unique needs of learners by meeting them at their learning level. To differentiate instructions for students, P1 suggested that “at the beginning of the school year, I give each child a learning style inventory.” The participant went on to say that strategies used for differentiation are “based on the type of learner that my child is and the reason from just simple paper-pencil all the way to computer-based programs or virtual voices assistant programs.” Additionally, students gain access to material based on levels, “I use those tools to differentiate instruction by giving students access to different levels of the same instruction or what is being taught.” P2 emphasized that scaffolding is a great strategy to

meet students at their, but caution on how to implement scaffolding "just break it down, giving it to them in small pieces, when they get that, add to it, building off with that knowledge, but making sure that they don't get that confused because that can be very confusing to them."

P3, P4, and P6 suggested that working with students one-on-one or putting students in small groups based on learning styles and needs are effective strategies to implement in the SPED classroom. P3 echoed these sentiments, "since I have a very low number of students in the classroom, I allow them to work in pairs or one on one." P4 mentioned "a lot of activities that we can do together as a group, but then when you're doing the evaluation or the assessment, it's more personalized toward each student, each pair or group depending on the levels of their needs." While P6 went further to discuss how she grouped students in that setting, "I may focus more on rotating groups and trying to have like independent groups, a group that is kind of okay and then my group that I can focus on helping more." Additionally, P4 suggested another strategy employed is discovery learning, "we provide the material on the topic and allow the child to explore, that helps too in a differentiated setting."

Another strategy to differentiate instructions shared by participants is the use of technology. P2 stated that "technology has played a huge part; hands-on, visual learning that comes with the use of technology." All participants highlighted some of the technologies that students have access to, which include laptops, iPads, Google Home, Siri, Alexa, graphic calculators, SMARTBoards. Also, students have access to software

programs such as Edgenuity, USA-Test Prep, Aimsweb progress monitoring software, and SRA *Reading Laboratory*.

Theme 2: Selecting Appropriate Technology

Data analysis results revealed that teachers and students have limited access to technology. Some classrooms have access to a class set of laptops, while other classrooms have access to iPads as well as desktop computers. The results also showed that students are not one-to-one with technology, and most times, teachers have to schedule access to shared laptop carts, and this sometimes hinders the instructional practice of differentiation. Kafyulilo et al. (2016) stated that schools or school districts with limited technological resources constitute a significant constraint to the effective implementation of technology by teachers in the classroom.

Subtheme 2a: Available Technology. Participants' responses from the interview revealed the technologies they have available in the classroom. Participants suggested, "we have access to the internet and iPads, and I also have a Google voice assistant," P2, P3, P4, P5, and P6 suggested they have access to "laptops, SMARTBoards, and desktops." P1 and P4 had "iPads" for daily usage as well as P3; however, P3 also has a single iPad that is not frequently used.

Subtheme 2b: Teachers' Selecting Technology. Participants' responses from the interview uncovered that teachers have very little say in selecting technologies to differentiate instructions in the classroom. However, since the school district has limited resources, participants mentioned that they used devices that they have available personally and pose benefits to their learners. P2 suggested, "I do a lot of stuff on my

own, as for assistive technology that other big schools have available that we don't, I'm always researching the ones of my interest." Additionally, 50% of the participants shared that the district selects technologies used in SPED classrooms, P4 mentioned, "realistically it depends on the district's resources. In the past they may have asked for suggestions, sometimes things that we suggested are provided, but at the end of the day, it all depends on the resources they have, and they provide to the best extent they can, the technology and the teacher has to design their lessons and design their instructions around what is provided." P5 went on to describe not being involved in the selection process of technologies, "for the most part, if the technologies are not provided, I can make suggestions, but I would not say I am 100% involved because you know this is basically above my pay grade, it would be whatever my superiors give me to use, that's what I have to use where technology is concerned, so if I have no computer, no laptop, I would have none to use unless the superior supply me with that technology." The participant added that some teachers purchase small technologies that are affordable and beneficial to instructions. P6 also echoed the sentiments of the district being the sole party selecting instructional technologies.

However, teachers having a voice in selecting appropriate technologies base on learners' needs is essential. P1 and P3 mentioned they had the autonomy or "freedom" of selecting technologies for instructional purposes. P1 stated that technologies are chosen for the students based on learners' uniqueness, "I choose assistive technology based on the exceptionality that each child has because I'm a SPED teacher." P3 further described the level of freedom to select appropriate technologies, "my school leaders gave me all

the freedom they always said that however you can differentiate, you can differentiate, you can teach in that style, this is your classroom you choose whatever is suitable for your student needs."

Theme 3: DVAs in Action

Data analysis results revealed that participants implemented DVAs in their classrooms to cater to the needs of their students. Bennett et al. 2018 posited that used to assist in the teaching and learning process, technology infuses learning environments with cutting edge learning devices, for instance, personal computers (PCs) and smart devices; broadens interactions in online courses, experiences, and learning materials; supports learning 24/7; produces 21st-century skills; extends students responsibility and motivation, and also speeds up the learning process. Participants discussed that they bought and implemented DVAs in their classroom to engage students, provide them with brain breaks, developing independence for research, and used the technology as an assistant to higher functioning students.

Using DVAs in instruction has been a game-changer for both students and teachers alike. Data analysis results revealed that participants perceived DVAs as providing a different voice in the classroom, especially when there are no assistants or paraprofessionals. P1 went on to explain this perception by stating, "I would normally have to stop in the middle of instruction with one child and go to another child when they have a question because I like to give individualized attention to each child because they require it. With having the voice assistant, the students know that they can use it to ask questions and that they will get the correct answer or an answer that is close to what I

would give to them. So, it's like having a second person in my classroom because my kids are able to use it to get information." P2 also shared a similar perception "it's wonderful because it was automatic because it came from someone other than me. I would ask a question, and they didn't know the answer, I would ask Alexa a different voice, and they were tuned in, that would get their attention."

Additionally, using DVAs helps learners who struggle with concepts in mathematics. P3 stated that "it really helps me a lot, like the other day we were doing some math problems and these students, they cannot focus on the long multistep equations. Then they were asking Alexa, that is how I felt like Alexa is doing something good." P4 shared that using DVAs in the classroom afforded "better child management because they have access to those DVAs. So each can be working on something while I have to work with a particular student or particular group."

Subtheme 3a: DVA Uses in the Classroom. Participants' responses from the interview uncovered that participants used DVAs such as Siri, Amazon Alexa, and Google home in their classrooms. P1 discussed how students use Google Home in the class, "students are able to interact independently with the devices because we did set up rules and regulations for using the device." She went on to explain how the device was first implemented before students interacted with the technology, "initially when we got it, we discussed it, what it would be used for, that it cannot be abused. It is only for educational related questions, and they will tell me that they need to ask Google a question. Then they can go ahead and do that." P3 echoed the sentiments of setting up clear directions for students to follow for best practices with using the Alexa in her

classroom, “so I started with some music couple of times, there are clear cut instructions I gave them, we all need to respect the teacher, and also the material.” P2 shared that she also has an Alexa in her room, but she was hesitant initially to use it in her classroom, “I didn’t have to plan really, I just decided that I was going to let it play out. The way to see how they would interact.” P4 shared she uses Siri on the iPads to differentiate instructions for her students, she added how she used the technology in her class, “you’re able to allow the child to do some independent work, while, perhaps you’re working with groups and you’ll be working with a small group. The others can work independently because they can use that DVA or the access to AI.” P5 also discussed using Alexa as one-on-one or independently “students work with Alexa, to be independent, in the sense that they are not just grabbing for an adult to help them do what they’re doing, but they use the technology to help them advance themselves in the being better learners or more independent learners.”

P1, P2, P3, P5, and P6 discussed using DVAs for vocabulary words, definitions, and spelling. P1 suggested, “I use the device mainly to get information that is directly related to whatever the content that is being taught. So, for example, when I was introducing independent variables and dependent variables, I had it written on my SMARTboard for my visual learners, but my learners that were audio, I would be like, okay, Google, what is an independent variable? And it would, of course, give that definition. And this and that would cater to my students that were not visual learners.” She added, “it always comes in handy, even as a teacher that is also new to the content area of mathematics. It’s there as an aid to help me to get information that I would have

otherwise go to a book and check, and so on and so forth." P2 shared that she uses Alexa for trivia questions for black history month. Songs are played over the intercom at school for students to guess the songs, and the students would use Alexa to find the singer of the song and facts about the singer. P3 suggested that Alexa is used for math, spelling, music, timer and weather forecast, "students will be waiting for that part to set up the timer from Alexa, and they will sit near to Alexa wherever I have set up, they will go near to the device, and they will start writing their prompt, and they will ask Alex to spell something." P5 also stated, "Alexa, sometimes to help them to search for like vocabulary words."

Subtheme 3b: Impact on Learning and Engagement. Participants' responses from the interview uncovered that participants were not able to assess student learning outcomes, but they perceived DVAs had a positive impact on students' engagement DVAs. P1 suggested, "I believe it is very advantageous for my kids to be able to use this; it assisted me greatly. And you know, they actually enjoy interacting with it. They enjoy getting the correct answer, and they're always very enthused to use it." P2 supported this perception by stating, "their engagement was awesome. I mean, as I said, we used her for many different things, you know, the learning outcome." She further described a personal experience with a student "I even had a student that doesn't talk a lot. That began talking to Alexa, so his mom was here today, and we were talking about it. And she said, Well, maybe I need to get one for him because he doesn't talk a lot at home. He's just a very quiet student. He's LD, but he's just very quiet unto himself, and she said, I've been looking for something to make him interact with others more. I hated to tell her teenage

boys love to come home and go to their room, and you might not see him until the next morning, but you know she said if I could get something like that because I told her it shocked me. The way he interacted."

P3 further explained that "when we have DVAs in the classroom, most of the students engage themselves in working alone, they will use it, and there are clear cut instructions I gave them." P4 enthusiastically explained, "it has a high level of engagement, of course, all kids love interacting with technology, and they're able to combine something that's fun with something educational, then they are more enthused, so I think there is a high level of engagement. P5 was delighted to share the students' level of engagement using DVAs. "They are fully engaged; they are fully engaged! They are just excited to be using it on a daily basis, and I realized that at the end of it all, I will get whatever activity I give them to do; whatever task is given to them are completed by the end of my class time." Finally, P6 lightheartedly described her students' engagement "they're really into it, like that was one of the quietest times I've ever seen them, for six graders to be quiet as actually listen, I feel like maybe that's where it is. Teachers are standing up there teaching, maybe Alexa should teach. They were so quiet, they were listening, waiting to find out you know what the answer was, and I was like No way. I mean, I feel like if it was utilized more, it could really be very helpful for them."

Subtheme 3c: Potholes with DVAs. Participants' responses from the interview uncovered that even though participants shared positive student engagement, participants' perceptions varied as it relates to potholes or challenges faced with DVAs in SPED classrooms. P1 was adamant of not having any challenges "I really don't face challenges

with using, it's very easy to use that it's very user-friendly, I don't face any challenges." But when asked about privacy she stated, "Privacy is always an issue whenever you're using something that is attached to the internet. I had some privacy concerns, but I've not had any issues with privacy." P6 also stated using the device did not pose a challenge "I don't think there's much of a problem because, well, because like I said, if I were to choose the topic, I would try to choose the topic to kind of meet everybody in the middle."

"P2 described her initial feeling before implementation "honestly was a little worried at first, what kind of questions are they going to ask Alexa because these are middle school kids and for the most part, boys. But they were very respectful." P3 shared that "when it comes to one on one it is fine, but when I have two students, they both want to participate or talk to Alexa at one time, and these are not every time, but sometimes I do have, not many times. Not that many challenges so far because it is only limited time for us to have this Alexa in the classroom."

P3 and P4 described how DVAs could cause students to become too reliant on the technology and not think for themselves, "in a resource class, I feel like most of the time they need to think about the brain, instead of AI comes when they have to depend on something else, but we are trying to make it independent like 16 times four. I want the student to do it by himself." P4 further elaborated on this point "it also has the drawback in that you do not want your students to be solely dependent on using just that option, you would like them to use it as a means of support, but you also want them to develop the independence of being able to do some things on their own." She further explained the

failures of technology “We have to be mindful of the fact that technology can fail in some instances, so you know, you have to have a backup plan. Let’s say, for example, in the building recently, guess perhaps due to weather, there were some problems with the Wi-Fi in the building. So, there are instances where technology can have its drawbacks. So, you have to be mindful of that to ensure that there is a backup plan, just in case technology may fail, but other than that, I haven’t really foreseen and any major challenges.” P5 stated that students sometimes have to shout to wake the device “it can be a little disrupting at times because, like one student will be doing something depending on their assessment that they’re given, and other students would be doing something else. So, just projecting your voice in the classroom, and that can be a little disruptive at times.”

However, to overcome challenges such as disruption, P1, P3, and P5 suggested that setting up classroom rules or protocols helps in combating these challenges. To mitigate challenges and for smooth implementation, P1 suggested, “we did set up rules and regulations for using the device,” she further added problems “I think it’s to my students’ advantage because of the rules and regulations.” P2 recommendation for larger class sizes, “so, in a class that has more kids, they would have to be rules and regulations.”

Subtheme 3d: DVA Take-Aways. Participants’ responses from the interview uncovered what participants learned from their experience using DVAs that could be helpful to other teachers considering options for their students. P1 contended that the DVAs could assist higher functioning SPED learners and “provide kids with instructions

just like I would or information the same way that I would" while she works other students with more critical needs. P2 suggested that Alexa is her "go-to" source to find fact "it was information at my fingertips" and help with scheduling her day with numerous IEP meetings. P3 recommended using Alexa to play "soothing music" to calm some students with behavior issues. P5 endorsed using Alexa for students who are "low functioning in their reading, reading materials, so it will help them in enhancing spelling of words, and vocabulary." She also said it "very good in DI in my classroom." Finally, P6 asserted that using DVAs in instructional practice is "a good supplement because I don't have an assistant" and a great tool for grouping as well.

Theme 4: TPACK and Differentiation

Data analysis results revealed participants' knowledge of technology, pedagogy, and content as well as their knowledge of the differentiation process and how having this knowledge influence selecting appropriate technologies to differentiate instructions for individual learners. Students enter the SPED classrooms with varying learning needs that SPED teachers must fill or close the learning gaps based on students' unique learning profile. With having a solid knowledge of technology, pedagogy, and content, SPED teachers are trying to close the knowledge gap. P1 stated that "trying to close wide range gaps between kids and then bring them up to stay left to grade level, and they're performing far below grade level. I will choose the technology that will help me to close that gap as best as I can."

Subtheme 4a: Technological Differentiation. Technological Knowledge (TK); refers to educators knowing the technologies that are available to them and proficient

knowledge to use them but also appropriate for the lesson (Mishra & Koehler, 2006). Participants' responses from the interview uncovered that some participants have a self-sufficient knowledge of using technology and using that knowledge to inform their instructional practices; select and implement to cater to learners' needs. P1 enthusiasm and high level of interest in technology stated that "lessons are much more enjoyable when technology is involved. So, based on the fact that I love technology, based on the fact that I'm always trying the next new thing, and I'm always trying to make my lessons very as interactive as they can be and cater to my learners." With the knowledge teachers have of technology, they "use that knowledge to decide what will work best for their students and how it will get them to be more excited about learning" in the SPED classroom. Moreover, one participant had a background in technology and shared that "I teach myself a lot, and I have a background in technology in the classroom. I use technology a lot in the classroom, it makes teaching easier, and it makes it more interesting for the students when they can get up and engage with the technology."

The knowledge of technology has a powerful impact on students with teachers using technology to captivate, maintain, and engage students. However, some teachers shy away from using technology, but "it is all about open-mindedness." P4 suggested that gaining knowledge and 21st-century skills require "open-mindedness on my part, on the willingness to do research, being able to test stuff and say this works, this doesn't work, and you just build on that." P5 recommended that having a good grasp on technology helps teachers keep up with their learners, "our children that we're teaching they are lovers of technology." Additionally, including technology in lessons and differentiated

lessons will “make them geared towards being more attentive, and as a result, they would basically, should grasp the content, and they would in turn learn.”

Subtheme 4b: Pedagogical Differentiation. The pedagogical knowledge (PK); is educators knowing their students and how they learn, as well as applying instructional best practices to meet learners’ needs (Mishra & Koehler, 2006). Participants’ responses from the interview uncovered that participants’ pedagogical knowledge is dependent on who you are teaching and “knowing your learners.” Also, educators must have a good foundation as far as the theories of learning, as teachers, “we have to look back at those theories of learning and pull from that.” P4 echoed the tenets of the differentiation theory “there are some theories that you know, are much more supportive of that. But lately, as you know, as we have moved further into the technological era, many persons are now drawn toward this DI, and a lot of research and a lot of information has come to the fore since Carol Tomlinson put forward a lot of stuff regarding DI.”

P4 also shared similar sentiments of pedagogical knowledge in DI is all about the learners “knowing what is appropriate for my students and what is inappropriate and what technology would suit their needs, and what they would basically destroy.” P6 also corroborated on the idea of “knowing your student as an important factor of pedagogical knowledge and differentiation, “it’s a matter of knowing your students, cater towards what my students need, but at the same time monitor them.” Pedagogical knowledge in the differentiated classroom should be intentional and “purposeful; if it’s not, then, it is not going be helpful for us or the students.”

Moreover, pedagogical knowledge is tapping into your why, as an educator. P4 stated that it is "delving into being a good teacher, and doing what's best for your students, it will really impact the extent to which you're willingness to incorporate technology I find it useful as long as you have that good foundation to say this is what the student needs and how can I provide that for my students." Having a solid pedagogical knowledge sets up all precedence for teaching and learning to take place in the classroom, knowing your learnings, what their learning needs are and the desired learning outcome or progress you want the students to make or that targeted "gap" as a teacher you set on closing.

Subtheme 4c: Content Differentiation. Content knowledge (CK); this refers to the content educators are teaching or the material they want their students to learn (Mishra & Koehler, 2006). Participants' responses from the interview uncovered some participants' content knowledge plays a significant role in selecting appropriate material to differentiate instructions to cater to the diverse learning needs of SPED students. Content knowledge impacts what you choose; that is, whatever content you want to teach, or the milestone or skill you want students to achieve will be dependent on how much you know, the kind of technology you use and how you incorporate the technology or the DVAs. With content are such as mathematics, have a solid foundation of the content is very important for the success of any DVA implementation. P1 suggested, "because my content area is more math, it's more procedural than it's more precise. Well, it requires a lot of procedures. So I have to be very deliberate about what I choose. So, you know, with math being as specific as it is, I have to be very deliberate about what I

choose to incorporate within my lessons." P4 stated that content knowledge is "impacted by what you want the students to know if the device is just going to be there, but he's not catering to the content, then it will be useless." The content you want students to learn should be matched with the appropriate technology to achieve the desired learning outcome. Content and technology go hand in hand, "you have to know the content, and then match the technology with what you want them to learn." Content knowledge is also about knowing the learners when teaching a particular skill or topic knowing who they are, knowing how they can use technology," determines the "deliberate" selection of technologies used for differentiation purposes.

Additionally, P2 suggested that having good knowledge of the content area that you teach, you find there are "different ways to do things." Moreover, one participant explained the correlation between content differentiation with pedagogical differentiation. P5 explained that "it relates to knowing my students, I'm teaching them the same content, but it is knowing who they are, knowing how they can use technology and if they need to learn how to use it and so forth."

Theme 5: Preparing and Training SPED Teachers with Technologies

Data analysis results revealed participants had mixed reactions as it relates to training and preparing teachers to teach students 21st-century skills, using new technology that students may be familiar with or providing them with the exposure of using these technologies. Today's age of learners in the classroom are tech-savvy and considered as tech intrinsic (Ahmadi & Reza, 2018). Since this group has experienced childhood in a cutting-edge technological society, they think outside of the box. They are more

technologically inclined, which is not quite the same as past ages. As teachers, it is significant to develop foundational conditions in training that help and support a development outlook for these learners while enabling them to use their specialized aptitude (Ahmadi & Reza, 2018). E. Wu (2017) also confirmed that teachers should receive step by step instructions on how to differentiate in their classrooms as well as providing teachers with access to the fidelity data of implementing new devices necessary to differentiate instructions effectively.

Subtheme 5a: Self Taught. Participants' responses from the interview uncovered that all participants are self-taught on how to use new technologies. Since the school district has limited resources, teachers are forced to use whatever technology they have access to personally. As such, teachers are using their technological, pedagogical, and content knowledge to inform their decisions to incorporate appropriate technologies for instructional purposes. After being the only teacher in her school to use a DVA to differentiate instructions, P1 stated: "most of what I do is self-taught." Utilizing prior knowledge of different strategies from using various assistive technologies such as the "read-aloud function in Microsoft Word and other things that my kids would benefit from and I apply those same principles to using the DVA." P2 and P3 echoed being self-taught with the devices they use at home, "I got some ideas to helping students using Alexa" and "that was the experience I had to bring in." P4 suggested that "the majority of what I may learn and other teachers may learn would have been researching that we have done on our own," while P6 blurted "self-taught."

Subtheme 5b: Professional Development. Since participants discussed that they were self-taught, they suggested that teachers can be better prepared to use devices such as DVAs if the school leaders or the school district could provide them with professional development or training sessions. P1 suggested that the school district could even use her classroom as a model "to my classroom data and how my students interact with DVAs, to show teachers that this is something that you could implement in your classroom that will do wonders for differentiation." P3 suggested that "we need to go to better professional development" sessions because these are "21st-century students and they want to listen more from a machine rather than human directly," even though students still need teachers. Though, P4 stated that she attended a professional development session concerning the use of DVAs. However, on a school or district level, "I foresee the need for further training, delving deeper into how we can incorporate this technology." She added that "as the school districts are more cognizant of the role that technology will play, then they will take the initiative for more extensive training and teacher preparation."

Professional developments should not only cater to teachers, but students should also have a workshop or seminar on how to engage and interact with DVAs discussing proper netiquette, the dos, and don'ts. P1 suggested, "both teacher and student learn the pros and cons of the device, and they both become familiar." When both teachers and students have a mutual understanding of DVAs, this will reduce some of the challenges participants described having in the classroom.

Evidence of Trustworthiness

As previously explained in Chapter 3, trustworthiness in a study is demonstrated when the researcher identifies how credibility, transferability, dependability, and confirmability provides evidence that the conclusions and findings are meaningful and useful in other settings.

Credibility

To achieve credibility in the study, participants were allowed to review and analyze the interview transcript as well as the results from the data analysis to rectify any inaccuracies as well as any essential information overlooked in the study — the transcript analysis-maintained consistency in the outcome and results of the interview (Patton, 2015). Additionally, I had an independent colleague who has no affiliation to the study setting, and participants review the data and findings for alternatives viewpoints and to reduce bias. I provided a discussion of deviation from the original plan in terms of participants; through these actions, I ensured dependability in this research.

Transferability

To achieve transferability, I provided a detailed description of the participants and the setting of the study in a way that did not compromise the participants' identity. In the "Background" section in Chapter 1, I outlined a detailed description of the study setting for readers' context. Also, in the Setting section of Chapter 4, the participants' characteristics were fully described for transferability. With the descriptions provided, I established the potential for transferability.

Dependability

To establish dependability in the study, I presented comprehensive descriptions of the actions and steps carried out throughout the research process. Also, I ensured that the instrument used for data collection aligned with the selected methodology and research questions. I achieved this alignment with a table that shows the alignment between the research questions, interview questions, and the framework. Additionally, I provided detailed descriptions of the data analysis process and all other data relating to the study. The data were recorded and stored using pseudonyms, and I supplied all the stakeholders identified in Chapter 3 with data results from the research to achieve dependability.

Confirmability

Confirmability in the study indicates if there is any partiality and or bias in the research (Patton, 2015). To achieve confirmability, I recorded and documented precise techniques and procedures so they could be reviewed and re-tested for consistency throughout the study. Participants' confidence was one of several strategies for improving confirmability. I triangulated data across interviews, comparing data from interview responses to cross-validate the data to converge on answering the research questions that guided this study.

Summary

The purpose of this basic qualitative study was to identify teachers' perceptions, knowledge, and strategies employed among SPED teachers using DVAs to differentiate instruction in their classrooms. This research also explored how SPED teachers use DVAs in their classroom and the training they received to prepare them for using these

devices in their content area. Six SPED teachers from a rural school district in a Southeastern state participated in either virtual or face-to-face semistructured interviews. I analyzed the data based on participants' understanding of differentiation, use of DVAs, knowledge of technology, pedagogy, and content, training, strategies used for differentiation, and involvement in selecting instructional materials for their classroom. I used open and axial coding for this process; 102 codes emerged from the open coding process, 14 categories later became subthemes of the five overarching themes. Participants defined differentiation as using various strategies, materials, and technology to reach all students and cater to their unique needs. Participants identified using multiple DVAs devices in their classrooms, such as Alexa, Siri, and Google Home. Participants identified that they used these devices to differentiate instructions in groups or one-on-one; also, they used the devices to help learners with spellings, vocabulary, music, and basic math problems. Participants stated that they were self-taught on using these devices and brought their personal experience with using these devices in the classroom. Participants noted that the school district had not provided any training in terms of these devices; however, they suggested professional development to help prepare teachers to use these devices in the classroom.

The conclusion, interpretation of findings, the implication for social change, and recommendations for future studies are discussed in Chapter 5.

Chapter 5: Discussion, Conclusions, and Recommendations

The purpose of this qualitative study was to identify teachers' perceptions, knowledge, and strategies employed among SPED teachers using DVAs to differentiate instruction in their classrooms. I conducted this study to establish a foundation on which policies and guidance can be developed and implemented within the local context. The nature of this study is qualitative and utilized a basic qualitative design approach. I used a basic qualitative study to describe a general essence or understanding of a problem or topic in question (Merriam & Tisdell, 2016).

Six SPED teachers from a rural school district in a southeastern state participated in either virtual or face-to-face semistructured interviews. I analyzed the data based on participants'' understanding of differentiation, use of DVAs, knowledge of technology, pedagogy and content, training, strategies used for differentiation, and involvement in selecting instructional materials for their classroom. Participants defined *differentiation* as using various strategies, materials, and technology to reach all students and cater to their unique needs. Participants identified using multiple DVAs devices in their classrooms, such as Alexa, Siri, and Google Home. Participants identified that they use these devices to differentiate instructions in groups or one-on-one. Also, participants used the devices to help learners with spellings, vocabulary, music, and basic math problems. Participants stated that they were self-taught on using these devices and brought their personal experience with using these devices in the classroom.

DVAs and AI can facilitate differentiation in SPED classrooms when used correctly. Most teachers do not have an assistant or paraprofessional in their classrooms

because the school district is located in a rural southeastern state, a very inexpensive device such as Alexa has the potential of providing one on one assistance to students based on their learning style and level. Having a technology that can facilitate one on one or allow students in resource classrooms to become more independent and less dependent on the teacher can help teachers in the differentiation process. However, teachers should use these technologies sparingly so that students do not become totally reliant on DVAs and used as a means of support and engagement.

Interpretation of the Findings

I developed three research questions to guide this study. I asked participants in the study to share their perceptions, knowledge, and strategies on using DVAs to differentiate instructions in SPED instructions. In this section, I provided an analysis based on the research questions. These research questions are:

1. RQ1 - What are the perceived challenges faced by middle school SPED teachers using DVAs in differentiating instructions in SPED classrooms?
2. RQ2 - What resources and strategies are known to be available to prepare middle school SPED teachers for differentiating instructions in SPED classrooms using DVAs?
3. RQ3 - What is the perceived knowledge of middle school SPED teachers related to the usage of DVAs to differentiate instructions in the classroom?

During the data analysis phase, five overarching themes emerged. These themes were (a) differentiation in SPED content, (b) selecting appropriate technology, (c) DVAs in action, (d) TPACK and differentiation, and (e) preparing and training teachers with

technologies. The findings in this research corroborate and expand on the literature previously discussed in Chapter 2 and how the conceptual framework presents insights into the results accordingly.

RQ1

What are the perceived challenges faced by middle school SPED teachers using DVAs in differentiating instructions in SPED classrooms? After analyzing the interview questions that corresponded with this research question, the findings suggested that teachers had little to no perceived challenges when using DVAs to differentiate instructions in SPED classrooms. However, the challenges that participants presented were a lack of independence, disruptive, technology failure, and privacy. Participants believed that the overutilization of DVAs might rob students of their ability to think for themselves. Since students ask the questions, and the device responds without probing or follow-up questions like teachers do, there is no need for them to use brainpower to process information. This finding is consistent with current literature. Reid Chassiakos et al. (2016) suggested that only a few of the publicly available apps discovered in the instructional segment of app stores had significant evidence to support the design and overall effectiveness towards learning outcomes but rather concentrating on rote academic abilities (memorization of picture-word association, numbers) instead of focusing on existing core curriculum materials and or instructions.

Additionally, if not appropriately implemented, DVAs can be disruptive. The device may not understand a question asked by students, and students usually increase their voice levels and or become frustrated in such instances, disrupting the classroom.

Also, if there is more than one device in the room with the same wake word such as “Hey Google” or “Alexa,” this will trigger the device(s) that might not be in use. Also, the findings indicated that participants were not concerned about privacy, except for one participant who reported that “privacy is always an issue whenever you’re using something that is attached to the internet,” but has not had any issues as it relates to privacy. This finding does not correspond with the current literature. Lang and Benessere, (2018) suggested that when one interacts with Alexa, the Echo streams sound to the cloud. The storage space of Alexa’s raised a plethora of concerns around privacy and security. However, participants suggested that when these devices are not in use, the devices are unplugged and muted, so they are not listening, and Siri is not always listening because it is manually activated.

RQ2

What resources and strategies are known to be available to prepare middle school SPED teachers for differentiating instructions in SPED classrooms using DVAs? After analyzing the interview questions that corresponded with this research question, the findings suggested that teachers have not received any training from their school leaders or school district. Since the school district has limited resources, the district does not provide teachers with DVAs. As such, all strategies used to implement these devices to inform their instructional practice and cater to the need of their learners were self-taught. Teachers pulled from the experiences they have with personal devices used at home and knowing the students they have to engage them in the classroom with DVAs. The findings echoed the sentiments of the need for support from school leaders and or

administrators. Tomlinson (2014) suggested that, while educators direly need this fundamental knowledge and skillsets to differentiate instructions effectively, the administrators and department heads likewise need to realize how best to support teachers with cutting-edge practices to deliver rigorous and DIs. Kafyulilo et al. (2016) stated that schools or school districts with limited technological resources constitute a significant blow to the effective implementation of technology by teachers in the classroom.

This finding confirms the literature on the support teachers need to implement technology in their instruction effectively. Wu (2017) established that teachers should receive step by step instructions on how to differentiate in their classrooms as well as providing teachers with access to data necessary to differentiate instructions effectively. Hur et al. (2016) suggested that teachers influence students' engagement in the classroom by the use of technology-aided devices and tools. Interactive writing activities, as well as educational games, contribute to increased student engagement. Used to assist in the teaching and learning process, technology infuses learning environments with cutting edge learning devices, for instance, personal computers (PCs) and smart devices; broadens interactions in online courses, experiences, and learning materials; supports learning 24/7; produces 21st-century skills; extends students responsibility and motivation, and also speeds up the learning process (Bennett et al., 2018).

RQ3

What is the perceived knowledge of middle school SPED teachers related to the usage of DVAs to differentiate instructions in the classroom? After analyzing the interview questions that corresponded with this research question, the findings suggested

that teachers are very knowledgeable of their students, the content they teach, and the materials and technology they select for use in SPED classrooms. The findings indicated teachers possess the requisite technological, pedagogical, and content knowledge needed to implement and use DVAs to differentiate instructions successfully; however, they noted that more formal training is necessary to iron out the nuances when implementing and using these devices. Renzulli, (2016); VanTassel-Baska, and Hubbard, (2016) suggested that the teaching of content-specific information and abilities necessary in the differentiation process incorporate learning about a plethora of pedagogical models and instructional strategies and tips on how to execute and modify these lessons to meet the specific learning needs of students. This finding also aligns with Tomlinson's (2014) four tenets of the differentiation process: content, process, material, and learning environment.

Additionally, the TPACK framework serves as a lens that educators can use to understand technology integration as the interplay between technology, pedagogy, and content (Koehler & Mishra, 2005). The knowledge of technology, pedagogy, and content helps to guide educators on the tendencies, affordances, and limitations of technologies, which allows them to be better suited for specific tasks over others (Koehler & Mishra, 2009).

Limitations of the Study

Limitations to trustworthiness in this study were minimal, since I was able to implement the planned strategies for credibility, transferability, dependability, and confirmability. However, the basic qualitative approach limited this study to the experiences and perceptions of the participants, which were self-reported instead of their

actual behaviors, as I did not observe participants during instructional practices (Yin, 2016). Additionally, this study was limited to a specific geographic location in a southeastern state. By limiting this study to a particular location, there was a limited amount of middle schools and teachers at that level to participate in the study. The study was also limited to only SPED teachers. By limiting this study to only SPED teachers, I did not garner the perspectives of general education teachers who had access or used the technology for similar instructional purposes. Also, I did not gather or include the views of elementary and high school SPED teachers that could increase the generalizability of the study. Additionally, only six of the 18 potential participants volunteered, consented, and participated in the study; as such, there were several missed opportunities to include other unique perspectives.

Additionally, this study was limited by the data collection method of semistructured interviews. Using only one method of data collection reduces the triangulation of the data, as I was only able to triangulate against other participants' responses to the same questions. Incorporating other methods of data collection would increase the generalizability of the results as well as reach more participants. This study was also limited to time since there was a small group of participants; participants had a short period to consent and participated in the study. Also, finding a suitable time was an issue in scheduling participants for interviews since participants were busy writing up IEPs.

Finally, even though I am a proponent of using technology in instruction, I safeguarded this study as research bias by promoting objectivity with conscious

awareness of my views on the subject matter. Mertler (2016) postulated that researchers who think objectively, they are often more inclined to record results that judgment and bias-free. Additionally, to mitigate bias, I used and external auditor described in Chapter 4 to identify potential bias (Mertler, 2016).

Recommendations

While conducting this study, I gathered invaluable data regarding middle school SPED teachers using DVAs and AI in the SPED classroom to differentiate instructions. Inequity relating to the selection of technology tools for general education content area versus SPED. Providing the necessary instructions to students by meeting them at their level and catering to their unique learning styles. Tomlinson (2014) posited that teachers are providing DIs act on the premise to engage learners "through different approaches to learning, by appealing to a range of interests, and by using varied rates of instruction along with varying degrees of complexity and differing support systems" (p. 3-4). With teachers having a solid fundamental knowledge of their content, pedagogy, available technology, as well as knowing their students, their interests, learning needs, and setting up desired learning outcomes and proper training, differentiation becomes less challenging and more routine.

After completing this study, there are additional areas for research, which includes a comprehensive analysis of the knowledge teachers lack using technology in low-income areas to differentiate instructions. Since this study was limited to middle school SPED teachers, further research is needed at the elementary and high school level that may include core content teachers. Additionally, more research is essential in the

field of using AI in the teaching and learning process to increase students learning. Conducting such study could influence how school leaders select technologies for classroom usage, as well as how using AI as an assistive technology to impact students who are considered gifted. Furthermore, additional research is needed in the area of the inequalities and disparities between technologies provided to SPED students versus the numerous software and technologies purchased for teachers and students in the general education setting.

Implications

As AI and DVAs are rapidly expanding in the consumer market as well as in the field of education, there has been an increase in usage of these devices to inform and differentiate. The education field is a pioneer in adopting technology to meet the high demands and create opportunities for learning in the 21st century and beyond. The outcome of this study has the potential to guide school and district leaders in developing policies, protocols, and arrange training and or professional development for teachers to differentiate instruction with modern assistive technology effectively.

Moreover, teachers are supportive of the use of DVAs, as they believe it responds to a demonstrated need. However, the data suggested that teachers need more support from leaders to aid them in implementing differentiation to help students be successful. Also, the state 4.0 rubric used to assess teachers on their instructional practice focuses on using technology and differentiation as a grading point for teacher evaluations. Therefore, to affect positive social change, schools and school district leaders should consult with teachers on increasing the availability of DVAs for instruction and by providing training

and professional development. The data presented that only one of six participants reported school district professional development support. Not only are teachers insufficiently supported, what teachers have learned on their own is not being shared with other teachers. Hence, this study sets the precedence for social change by offering both the opportunities for teachers to participate in professional development activities as well as teachers on the leading edge could lead professional development initiatives to share their knowledge with colleagues.

Furthermore, the schools or school districts could appoint expert teachers, proficient in the use of DVAs, and differentiate to training new and struggling teachers. From this initiative, schools could develop a mentorship program. Kafyulilo et al., (2016) confirmed that for a professional development session to be productive and successful, the teachers should be actively involved in taking their different learning needs and actively be part of various opportunities for learning that specifically focused on their school, and continuously support a collaborative teaching and learning process.

Finally, the data suggested that teachers did not have a voice in selecting the technology for use in their classrooms. However, they expressed their preference for being a part of the technology selection process. Since learners are so diverse, it would be desirable to get teachers involved in choosing the most effective technology that complements their skill-set as well as what caters to their learners' needs. This study may provide school leaders with an understanding of the importance of the teacher's voice when selecting classroom technology for differentiation in their classroom instructions based on students' needs. As such, school leaders may develop a committee to gather

data on teachers' opinions on selecting new or currently used technologies that may impact the success of the learners in their classrooms.

Conclusion

The data presented in this study came from semistructured interviews conducted with six SPED teachers in a rural school district in a southeastern state. The data were analyzed to identify teachers' perceptions, knowledge, and strategies employed among SPED teachers using DVAs to differentiate instruction in their classrooms. The data signaled that teachers use these devices to cater to the needs of their students based on their learning styles. Teachers using DVAs with their auditory learners expressed more benefits. Additionally, teachers reported that using DVAs to differentiate instruction acknowledged that the devices engaged students more in the lesson or activity it is being used for. Learners tended to pay more attention or got quiet to interact and listen to the responses coming from DVA devices. Also, teachers suggested that using DVAs can afford SPED learners with the ability to be independent, which is relying on the teacher less when they have specific questions.

However, the data presented that prolonged or overuse of these devices may rob students of their independence to think for themselves. The data suggested that teachers had little to no concerns in terms of the privacy issues with using these devices in an educational setting. For teachers to successfully implement DVAs in the classrooms, they recommended setting up strict classroom rules and protocols before students using these devices to differentiate or any instructional purpose. The data also presented that teachers have not had any formal training in using DVAs for instructional purposes and suggested

that schools or district leaders look into the possibilities of adopting these technologies and train teachers on how to use them on the possibility of meeting the needs of students with learning disabilities by harnessing the power of technology.

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Appendix A: Letter of Cooperation

Adrian “Rick” Weir
[redacted]
[redacted]
Cell: (843) [redacted]
For attention: [redacted]

REQUEST FOR PERMISSION TO CONDUCT RESEARCH IN SCHOOLS

Dear Dr. [redacted],

My name is Adrian “Rick” Weir, and I am a doctoral candidate at Walden University in Minnesota. The research I wish to conduct for my Doctoral dissertation involves “Perceptions, Potholes, and Possibilities of Using Digital Voice Assistants (DVAs) to Differentiate Instructions.” For this research, I will serve as the primary researcher. The purpose of this qualitative study is to identify teachers’ perceptions, knowledge, and strategies employed among SPED teachers using DVAs to differentiate instruction in their classrooms. Additionally, this study will expose knowledge gaps and missing/required strategies to improve implementation.

I am, at this moment seeking your consent to conduct this study within the school district with several SPED teachers to understand their choices and implementation of assistive technology in their classroom instructions to increase students’ engagement and learning outcomes. The research involves conducting semistructured interviews with SPED teachers. The interviews will not include students, nor will it include academics.

Your consent to proceed with this study is much appreciated, as it will enhance this study. The Walden University's Institutional Review Board (IRB) will approve my study once I have obtained your approval. Upon completion of the study, I undertake to provide the school district with a bound copy of the full research report. If you require any further information, please do not hesitate to contact me at [redacted] or [redacted].

Thank you for your time and consideration in this matter.

Yours sincerely,

Adrian Weir
Doctoral Candidate Walden University

Appendix B: Inform Consent

My name is Adrian Weir; I am a student at Walden University, pursuing an EdD in Educational Technology. My research is entitled "*Perceptions, Potholes, and Possibilities of Using Digital Voice Assistants to Differentiate Instructions."* You might already know me as a business teacher at Mullins High School in Marion school district, or you might know me in my previous role as a science and math teacher at Johnakin Middle school in the same district, but this study is separate from those roles. I obtained your information from the district directory of SPED teachers. This form is part of a process called "informed consent" that outlines the study before you decide to participate.

Background Information:

The purpose of this qualitative study is to identify teachers' perceptions, knowledge, and strategies employed among SPED teachers using DVAs to differentiate instruction in their classrooms. Through this study, I am seeking to establish a foundation on which policies and guidance can be developed and implemented within the local context. Understanding the usage of these technologies in the classroom may offer teachers information regarding the benefits and or limitations that DVAs have on pedagogy.

To participate in the study, you must meet all the following criteria:

a) middle school special education teachers

b) employed by the school district

c) one-year teaching experience,

d) use various differentiation strategies and technology.

Procedures

If you agree to participate in this study, you will be asked to:

- participate in a 30 to 45 minutes interview with ten questions at your school of employment or virtually via zoom conferencing tool
- consent to the recording of interviews
- answer questions as it relates to differentiation and SPED instructions
- honestly respond to interview questions openly and freely
- Participate in a 10-minute review of the transcript of your interview for accuracy

Here are some sample questions:

- How do you differentiate for students in your classroom? Give examples.
- What strategies come to mind when you hear the term differentiated instruction?
- How much training have you received using Digital voice assistant for instructions?

A face-to-face interview will be scheduled at your worksite or virtual interview at your convenience. The data you provide will be recorded using a digital recorder, analyzed, and compared with a sample size of 10 to 12 other SPED teachers. Your answers to these

questions will be transcribed from the audio recording and returned to you for verification of accuracy.

Voluntary Nature of the Study:

This study is entirely voluntary. You are free to accept or turn down the invitation. No one at the school or school district, nor will I treat you differently if you decide not to be in the study. If you decide to be in the study now, you can still change your mind later. You may stop at any time.

Risks and Benefits of Being in the Study:

Being in this type of study involves some risk of minor discomforts that can be encountered in daily life, such as fatigue, stress, or becoming upset. Being in this study would not pose a risk to your safety or wellbeing. There is minimal risk for your co-workers to overhear you answering research questions in a room with the researcher. Your identity or responses to interview questions will never be disclosed and will remain completely confidential. You have the option to participate in this study outside of your worksite or virtually to minimize this risk. There is also a minimal risk that you may disclose violations of workplace policies. No identifying information that could potentially identify you will be disclosed. Your personal information will remain confidential. There may be no direct benefit to you, but the results of your participation may provide an opportunity for public education leaders and instructors to gain a better understanding of the benefits and challenges of implementing the Digital Voice Assistants in SPED or other classroom settings.

Payment

There is no compensation, cash, or gift, for participating in this study, your participation is voluntary.

Privacy

You will have complete confidentiality, and should the research study be published, your name or any descriptions that would identify you will not appear or be used, and your results will remain in confidence. Reports coming out of this study will not share the identities of individual participants. Details that might identify participants, such as the location of the study, also will not be shared. The researcher will not use your personal information for any purpose outside of this research project. Paper-based data will be kept secure in a locked file cabinet, and electronic data will be stored and protected by passwords on a computer and cloud storage. Pseudonyms will be used in place of names, and all identifying information will be excluded from the study. Your identity will be kept confidential. Data will be held for at least five years, as required by the university, and then destroyed by deletion and document shredding. The results of the research study may be published, but your identity will remain confidential, and your name will not be made known to any outside party.

Contacts and Questions:

You may ask any questions you have now, or if you have questions later, you may contact the researcher via email at adrian.weir@waldenu.edu or [redacted]. If you

want to talk privately about your rights as a participant, you can call the Research Participant Advocate at my university at 612-312-1210. Walden University's approval number for this study is 01-30-20-0705456, and it expires on January 29, 2021.

Obtaining Your Consent

The researcher will give you a copy of this form. You should keep the copy for your records. If your consent has been provided by email, you may also print or save this consent

form for your records. If you feel you understand the study well enough to volunteer participation, please indicate your consent by signing below. If you are giving consent via e-mail, please reply to this email with the words, "I consent."

Signature of the interviewee _____ Date _____

Signature of the researcher _____ Date _____

Appendix C: Interview Questions

Research Questions	*Interview Questions*
Questions about the teacher	A. How long have you been teaching? Have you always been a SPED teacher? How many years as a SPED teacher? B. Do you have a paraprofessional in your classroom? If so, what is their role in the classroom?
Questions about SPED/Differentiation/Their students	C. Describe your (SPED) students (quantity, grades, subjects, learning issues, etc.) D. What is your definition of differentiated instructions? i. What strategies come to mind when you hear the term differentiated instruction? ii. How do you differentiate for students in your classroom? Give examples.
Questions about the technology and other instructional materials/tools available to the teacher	E. How do you or school leaders go about selecting, evaluating, and determining appropriate instructional materials and or assistive technologies for the differentiation process? F. What kind of technological resources do the students in your classroom have access to?
Questions about the impact of using DVAs	G. Describe your level of access to DVAs in your classroom?

	i. Which DVAs do you have access to? ii. How has the DVA impacted your ability to deliver instruction to your students? iii. How would you describe the engagement and learning outcomes of students after using DVAs to differentiate instructions?
RQ1- What are the perceived challenges faced by middle school SPED teachers using DVAs in differentiating instructions in SPED classrooms?	H. What are some of the challenges, if any, you have faced when planning and implementing DVAs to differentiate instructions? i. Describe how the use of AI/DVAs made it easier or more difficult for you to differentiate instructions? Please explain. ii. Are privacy issues a concern as it relates to the implementation and use of DVAs in your content area?
RQ2 - What resources and strategies are known to be available to prepare middle school SPED teachers for differentiating instructions in SPED classrooms using DVAs?	I. How much training have you received using Digital voice assistant for instructions? i. How are you/teachers being trained on how to use and incorporate the new DVA to provide differentiated instruction to students?

	ii. How could teachers be better prepared to meet the challenges of using DVAs?
	J. What is your level of involvement in the selection of the technologies used in the teaching and learning process?
RQ3 - What is the perceived knowledge of middle school SPED teachers related to the usage of DVAs to differentiate instructions in the classroom?	K. How does your technological knowledge influence your selection and use of technology to differentiate instructions in your classroom?
	L. How does your pedagogical knowledge influence your selection and use of technology to differentiate instructions in your classroom?
	M. How does your content knowledge influence your selection and use of technology to differentiate instructions in your classroom?
	N. What have you learned about using DVAs that can help you be successful in differentiating instruction?