THE EFFECTS OF TECHNOLOGY INTEGRATION ON AVID STUDENTS COMPARED TO OTHER MIDDLE SCHOOL STUDENTS

by

Kathy Veronica Hardy

Liberty University

A Dissertation Presented in Partial Fulfillment

Of the Requirements for the Degree

Doctor of Education in Educational Leadership

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ABSTRACT

Student disengagement in the learning process is problematic, especially in the middle grades. Studies show that technology infusion in classroom instruction promotes student learning and behavior when effectively integrated. Employing the theory of constructivism, this study explored technology infusion in a college and career readiness program based on the assumption that integration aids in the construction of knowledge. The purpose of this study was to analyze the difference between the performance scores of AVID and non-AVID groups in middle schools. Archived test results for the Preliminary Scholastic Achievement Test (PSAT) were compared on a sample of non-AVID and AVID middle school groups in schools with both programs located in Texas. A quantitative casual-comparative design explored the dependent and independent variables. PSAT performance scores represented the dependent variable. The independent variable was defined as the type of instruction provided (AVID vs. Non-AVID). The independent samples *t*-test tested hypotheses for significance at 0.05 level. There was not a statistically significant difference in the mean scores of the two groups in the schools. The results had implications for determining whether technology integration assists in motivating students to perform and for aiding the teaching profession in general in decision making regarding infusing technology in classroom instruction.

Keywords: Advancement Via Individual Determination (AVID), computer instruction, Preliminary Scholastic Achievement Test (PSAT), technology integration, technology instruction, digital technologies

Dedication

First, this document would not have been possible without guidance and strength from God. I dedicate this work to my husband, Mario, for always making me feel as though I could do anything. Mario never made me feel guilty about the times that I sacrificed working on my doctoral studies. He made everyone in the virtual world think that I was the most intelligent person he'd ever met. I dedicate this document to my oldest son, Tyler, who never failed to forward the correct documents that I always forgot to send to my laptop prior to leaving for Liberty to attend Intensive Residency Sessions. This document is dedicated to my youngest son, Jaydon, who felt it necessary many nights to stay up with me until I completed my assignments, even if it was a school night for him. I dedicate this document to my Mommy, Mary Rose Koonce, who passed away February 2, 2021. She was my biggest encourager and motivator. She always told me that I could do anything that I desired to do. I also dedicate this document to my daddy, Leslie Koonce, who continues to believe in me; my admired brother, Michael E. Chapman, who passed away in 2008 and to my inspirational grand-mommy, Eva Mae Peterson who passed away in 2019. I dedicate this document to my aunt, Judy Williams, who is a retired educator and mentor. I dedicate this document to my aunt who never ceased to encourage me, Laura Ann Nobles, who passed away March 3, 2021, which was exactly a month and a day after my Mommy passed away. It is in my family's memory that I was encouraged to do my very best as I continued to finalize my manuscript. Lastly, I also dedicate this document to my family, friends, and mentors who were inspirational in my journey. Your words of encouragement inspired me to continue when I did not feel like persevering through the many long nights of reading lengthy chapters, responding to quizzes and tests, research, statistics, and writing papers.

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List of Abbreviations

Advancement Via Individual Determination (AVID)

International Society for Technology in Education (ISTE)

National Assessment of Educational Progress (NAEP)

National Center for Education Statistics (NCES)

No Child Left Behind Act (NCLB)

Preliminary Scholastic Achievement Test (PSAT)

Problem-based Learning (PLB)

Program for International Student Assessment (PISA)

Software Package for the Social Sciences (SPSS)

CHAPTER ONE: INTRODUCTION

Overview

Technology in various forms has become a part of our everyday lives. In today's 21st Century classrooms, it is common to see computers and other technological devices integrated in classroom instruction at all levels. This chapter is an overview of a study that examined the effects of classroom technologies on student learning. The problem, background of the topic, and purpose of the study are included, along with the significance of the study. The chapter concludes with the research question and key terms applicable to the study.

Background

The historical context of the presence of technology in many facets of society has been captured in volumes of print material. The history of technological inventions illustrates that intelligent functions of the human brain are captured in the creation of the computer and other adaptive technologies (Gahn et al., 2016; Reboot Foundation, 2019). The borrowing of human intelligence has enabled computers to now perform problem solving, math for instance, at a rate that far exceeds the human brain (Kyriazis, 2015; Rodrignez-Ramos, 2018; van Paasschen, 2017). However, the infusion of technology in classroom instruction has a history of concerns about making classroom instruction relevant to students' needs and using the computer and other supportive technologies to assist in student learning (Bell et al., 2015; Posso, 2016). Posso (2016) is among researchers who suggested using student-centered technology customized to individual needs as a response to the concerns.

The literature associated with infusing technology in the classroom includes stress on the need for motivating student learning (Montoro et al., 2019; Smith, 2018). The need to motivate students for engaging in learning is apparent in the high rates of high school dropouts, low graduation rates, and the length of time some students remain in school before graduating (Stark & Noel, 2015). A problem is that some teachers are unaware of how best to integrate technologies in their instructional practices and others seemingly have a fear of technology (Bouygues, 2019;

Landrum, 2015; Reboot Foundation, 2019; Zheng et al., 2016). However, technology has evolved as a motivating mode for engaging society in communicating, socializing, and learning (Hossain et al., 2017). The motivational effects are attributed to the increased storage of information such as video and audio (Rodrignez-Ramos, 2018).

Recognized is that in some brain functions computer technology has become a teacher to the human brain and provides a fascinating mode to entice the attention of users to solve mathematical and other problems (Herodotou, 2017). Hossain et al. (2017) explained how learning systems model students' levels of knowledge and then can present new problems that are challenging at the right level. Further, computer-based interactive learning experiences offer challenges that enable students to acquire new knowledge through inquiry-based learning. Hossain et al. (2017) demonstrated how students perform real experiments, data analysis, and test hypotheses in a cloud laboratory through computers. According to Kyriazis (2015), the possibility of enhancing the function of the bran is dependent in part on digital and other technology.

Arguments about the infusion of technology in the classroom as a teacher show support for and against the infusion. Research has shown that technology permits interaction with one's surroundings and is viewed as a non-threatening and motivating tool to promote student learning in authentic learning environments **(**Dinçer & Doğanay, 2017; Wardlow, 2016). Research has also shown that students' performance in reading, writing, and mathematics improves when technology is effectively integrated into classroom instruction (Bouygues, 2019; Reboot Foundation. 2019). A number of current researchers also report findings in support of various technologies enhancing student motivation and performance (Bouygues, 2019; Byrne et al., 2016; Kardefelt-Winther, 2017). Computer and other technologies are incorporated in Advancement Via Individual Determination (AVID), a career readiness instructional program focused on student learning and performance. Program outcomes include increased graduation rates and scores on performance assessments (AVID, 2016, 2020).

Through using a data set from the Organization for Economic Cooperation and

Development's 2012 Program for International Student Assessment, Posso (2016) examined the effects of the Internet and video gaming on educational achievement in mathematics, reading, and science among 15-year old Australian youth. The results suggest that using the Internet as an online social network reduces academic achievement. Conversely, playing online games increases scores. Posso acknowledged that the rate of use of the Internet and video gaming for social networking is high and associated inadequate time management with poor academic performance as a result of the Internet. However, video games potentially allow students to apply and sharpen skills learned in school to include creative thinking, visual imagery, and problem solving (Byrne et al., 2016). Studies reported in the literature show conflicting views regarding the relationship between video gaming and academic performance (Bell et al., 2015; Pew Research Center, 2016).

Studies have explored other forms of digital technologies and their influence on student learning. For example, Kardefelt-Winther (2017) review of literature found that the computer and other technologies have a positive influence on the mental well-being of students when used moderately. Agreement can be found on this point among several researchers. Bouygues (2019) and the Reboot Foundation (2019) found that decreased usage of the computer resulted in higher performance scores in reading and mathematics than prolonged use of the computer. The difference in performance was also associated with the task being performed, and findings revealing that computing experiences had implications for the form of pedagogy teachers employed, communications between the teacher and students, and classroom management.

Digital technologies integrated in the classroom have implications for motivating students. Studies reveal that integrating technological devices, such as clickers, tablets, and intelligent tutoring systems, promotes collaboration among students and improves social skills (Kardefelt-Winther, 2017; Reboot Foundation, 2019). These studies show that not only is academic performance influenced, but the student overall is influenced positively through the integration of technologies in the learning environment. Although the research reveals computer assisted instruction and other technologies assist teachers in instructional delivery, also recognized is the need for professional development to prepare teachers for effective integration (Bouygues, 2019).

There are arguments for and against infusing technology in the classroom that center on student learning. Learning theories provide guidance in identifying approaches to address this need. Constructivism is among such theories where individuals such as Piaget and Vygotsky illustrated processes by which people construct knowledge. The process included interacting with one's surroundings, input from surroundings, and integrating new knowledge into existing knowledge (Piaget, 1952; Vygotsky, 1978). Some technologies infused in classroom instruction promote interaction with real and virtual environments. Howard et al. (2017) presented research to show how peer interaction in a computer-based, collaborative learning environment can result in students jointly constructing understandings and shared meanings. The researchers concluded the need for software to simulate peer tutoring activities

The process of knowledge construction also involves using past knowledge or history and symbolism to construct new learning (Vygotsky, 1978). Researchers examining the perspectives of Piaget conclude that the theory helps to explain that when new experiences are encountered; people adapt their thinking; as a result, new knowledge is constructed (Olusegun, 2015). Suhendi and Purwarno (2018) noted that the combined ideas of Piaget and Vygotsky on constructivism and learning have "an impact on the development of both micro and macro world technology" (p. 87). This impact is inherent in the movement for developmentally appropriate practice focused on addressing each child's needs. These ideas guide the choice of instructional activities and experiences that challenge students, but also permit them to achieve (Currie, 2016). Technology is among classroom resources applicable to helping students construct knowledge in a developmentally appropriate manner (Kardefelt-Winther, 2017).

This background to the study included the recognition that technology infusion in classroom instruction promotes student learning and behavior when effectively integrated. The integration of technology is a response to how students construct knowledge and the need for motivating them to become active participants in the teaching and learning process. This study explored technology infusion based on the assumption that the integration aids in the construction of knowledge. That assumption was reflected in the research questions posed for the study. The section to follow contains the problem of the study and the gap in the literature regarding specific forms of technology in classroom instruction.

Problem Statement

Prior studies questioned the influence of technology integration as an instructional approach on students' performance. Several have not found a statistically significant difference in performance of groups with and without technology integration (Bouygues, 2019; Montoro et al., 2019; Posso, 2016). Similar to the intent of this study, Islam et al. (2018) conducted a comparative study of students taught through a flipped class that used technology verses traditional instruction. The intent was to compare the achievement of learning outcomes of dental students enrolled in the flipped classroom with outcomes of students enrolled in a traditional lecture based classroom. Students were randomly selected for the control and experimental groups. A test administered at the end of each session determined the outcomes of instruction. The findings showed higher achievement total scores for students who received the technology-related instruction as opposed to the traditional lecture mode; however, differences in performance scores between the two groups were not significant.

Many 21st Century middle school students have become disengaged in the learning process. They are not motivated by the traditional methods of teaching styles, such as when teachers stand behind podiums and recite verbatim from a PowerPoint presentation. Although studies cited have not found statistically significant differences in performance with or without technology integration, studies are needed that may provide additional insight regarding technology integration. This study adds to the literature related to the effects of technology infusion on the performance of middle school students. An awareness of how Advancement Via Individual Determination, AVID, may impact the performance scores of students enrolled in a large urban school district also contributes information for use in decision-making regarding the selection and use of technology in the classroom. Students at the site of the study were not performing well academically in their classes or on standardized tests. It was not known what influence the AVID program had on students' performance scores. The problem was that the literature has not adequately addressed how participation in AVID has impacted students' Preliminary Scholastic Assessment Test (PSAT) scores.

Purpose Statement

The purpose of this quantitative casual-comparative study was to analyze the relationship between the performance of groups in the AVID program and those who were not. The independent variable is composed of two groups; those in the AVID program and those who were not. The dependent variable, PSAT total mean scores, were examined to determine whether there was a significant difference in mean scores of the two groups during middle school. The population for the study was scores of middle school groups in public middle schools in a large urban school district in Texas. AVID participants are underrepresented minorities by gender and ethnicity.

AVID is a college and career readiness program that encourages the use of technology and features nine core strategies: collaborative structures, collaborative study groups, family engagement, focused note-taking, higher level thinking, organizing materials, philosophical chairs, relationship capacity, and a Socratic seminar (AVID, 2020). AVID instruction incorporates computers/digital technologies as major instructional tools in daily instruction and other specialized support features (AVID, 2016). The PSAT is a practice test of the Scholastic Assessment Test. The test measures skills in reading, writing, and math of students, and it's administered in many middle schools as a preparation assessment, but it is typically taken by 11th grade.

Significance of the Study

Technology integration has been proven effective regarding student achievement, especially with at-risk students. Technology can be costly; therefore, it is important for school districts, leaders, and educators to evaluate the effects of the modern technology resources and tools that are available to assist in instruction in today's classroom. This study has significance for determining whether the technology program is cost effective for the outcomes produced in terms of performance scores. Given that studies (Byrne et al., 2016; Kardefelt-Winther, 2017) show technology infusion results in positive behavior and academic performance, the study's results add to the literature regarding whether the AVID program is a promising practice. Also, as the literature links academic performance with motivation for learning (Hossain et al., 2017; Kardefelt-Winther, 2017; Montoro et al., 2019; Smith, 2018), this study had the potential to determine whether the technology integration assists in motivating students to perform. Findings from the study can aid the teaching profession in general in decision making regarding infusing technology in classroom instruction.

Research Question

This study intended to determine differences in mean PSAT performance scores through addressing the following question:

RQ1: Is there a difference between the total performance mean scores of groups in Advancement Via Individual Determination and performance mean scores of groups in Non-Advancement Via Individual Determination in middle schools as measured by the Preliminary Scholastic Assessment Test?

Definitions

Terms cited are used as they pertain to the study.

1. *Adaptive Learning* - This is "a technology-based or online educational system that analyzes a student’s performance in real time and modifies teaching methods based on that data" (Lynch, 2017)
2. *AVID* - This is a college and career readiness program that features nine core strategies: collaborative structures, collaborative study groups, family engagement, focused note-taking, higher level thinking, organizing materials, philosophical chairs, relationship capacity and Socratic seminar. There are four domains, which are instruction, systems, leadership, and culture within schools, and they are used to implement and monitor the

program school-wide (AVID, 2020). AVID instruction incorporates computers/digital technologies as major instructional tools in daily instruction and other specialized support features (AVID, 2016).

3. *AVID Students* - These students represent underrepresented demographic groups by ethnicity and gender (AVID, 2020).
4. *Digital Technology* - The definition "includes digital devices such as computers, tablets and mobile phones, as well as the many digitally mediated activities that children today engage in via these devices, such as using the Internet, going on social networking sites, chatting online or playing video games"(Kardefelt-Winther, 2017, p. 6).
5. *PSAT* - The Preliminary SAT is a practice version of the Scholastic Assessment Test taken only once per year, usually in 10th or11th grade. The PSAT is 2 hours and 45 minutes long and tests skills in reading, writing, and math (Kaplan, 2019).

CHAPTER TWO: LITERATURE REVIEW

Overview

This chapter contains a discussion of the theoretical framework selected for the study and a synthesis of the related research. The related literature provides foundational information supporting the examination of a program focused on the use of technology in instructional practices at the middle school level. Research related to the latest forms of technology, technology infusion, student motivation, and constructivism and technology is discussed in the context of enhancing student performance. The review of the literature culminates with an explanation of the AVID program, the phenomenon of the investigation on student performance.

Theoretical Framework

Constructivism served as the theoretical framework for this. The foundation of constructivism stems from the theoretical perspectives of Dewey (1929), Bruner (1961), Vygotsky (1962, 1978), and Piaget (1962) with its basis being a process of knowledge that incorporates aspects of social, and cultural influences (Olusegun, 2015). The perspectives of constructivist theorists are reflective of constructs in the fields of philosophy, psychology, sociology, and education (Olusegun, 2015). The basic premise of constructivism is that learning is constructed, and according to Dewey (1961, 1929) and Bruner (1961), the construction of learning is active and influenced by one's experiences. Experiences allow the students to understand and build upon new information which Dewey (1961) identified as the social construction of knowledge.

Key concepts of the theory include assimilation and accommodation in which new knowledge gained is incorporated in prior knowledge, and then reframed to accommodate the individual's expectations (Olusegum, 2015; Piaget, 1952). The concepts of constructivism reveal that if learners are able to construct or create an understanding of how ideas or lessons work using prior knowledge or prior experiences, they will mentally process the information (Bohonos, 2013; Olusegum, 2015).The framework for this study was informed from the views of Piaget (1952, 1961, 1969) and Vygotsky (1962, 1978).

Piaget was a Swiss psychologist who developed learning theories and argued that individuals proceed through distinct stages of cognitive development in which they construct new knowledge through what he described as accommodation and assimilation. According to his theory, an individual is able to integrate new experiences in prior knowledge from evaluating experiences to determine their value (Olusegum, 2015). The individual accommodates for experiences that do not meet their expectations through reframing those expectations (Piaget, 1969). Eggen and Kauchak (2013) explained this process as individuals establishing order in their lives. Eggen and Kauchak suggested that when individuals are unable to make sense of the new experiences, they readjust their thinking to the new experiences. In essence, Piaget's (1969) focus related to constructivism was to provide directions on how people learn through their interaction within the environment.

According to Piaget (1952), individuals progress through four stages of cognitive development during their lifespan: sensorimotor, preoperational, concrete operational and formal operational. The concrete operational stage focuses on the cognition of individuals aged 7-11 years and the formal operational stage ranges from 11 years and upward (Piaget, 1952). Piaget associated cognitive abilities of humans with each stage. For example, the middle school learner falling in the age range of 11-14 years would cognitively function between operations characteristic of the concrete and formal operational stages. These cognitive operations include the ability to view situations from different perspectives, think logically, use deductive and inductive reasoning, use problem-solving skills, and assimilate and apply information to other concepts (Lefa, 2014).

Piaget’s (1952) theory of constructivism offers support to the idea that a connection between play experiences and the process of learning is essential to the fundamentals of education, as well as the many other fundamental concepts and cognitive constructions. His philosophy was that students learn by doing (Lefa, 2014). Implied from Piaget's beliefs for student learning is that as students engage in experiences, they see modeled activities through lenses and internalize those aspects that are more relevant and meaningful to them (Caskey & Anfara, 2014; Piaget, 1961).

Piaget's (1952) theory focuses on the impact of student learning in the classroom, which includes the role of the teacher as well. He addressed the functions of teachers as facilitators, and not as lecturers (Piaget, 1952). Piaget's theory aligns with the idea of students as active learners who construct new knowledge by applying prior knowledge, mental capacity, and experiences through accommodation and assimilation (Lefa, 2014).

Technology integration based on Piaget's (1952, 1969) cognitive development theory focused on constructivism suggests that students engage more in critical thinking about concepts as they are familiar with what to research when using technology resources. When looking at the traditional classroom setup, a constructivist's differentiated classroom is equipped with student –led activities, such as technology inspired and initiated resources (Tomlinson, 2015). These activities initiate hands-on engagement, encourage and challenge students to think critically, and develop interest and motivation in the learning process (Tomlinson, 2015).

Vygotsky (1978), a Russian sociologist, had similar views as Piaget in describing constructivism. However, Vygotsky attributed one's cognitive development more as an influence of culture, which varies according to culture. A review of both theorists showed that Vygotsky did not view the construction of knowledge associated with distinct stages as did Piaget (Bhutto & Chhapra, 2013).Vygotsky proposed that with the assistance of teachers, parents, or adults, children will perform better and challenge themselves. One of the main factors, however, is that the child's degree of presentation will develop more as the adult modifies their support (Bhutto & Chhapra, 2013). For Vygotsky, the emergence of concept mastery occurred in the zone of proximal development (Moll, 2014).

Researchers who analyze Vygotsky's work also suggest that mastery occurs through interaction and manipulation of various resources including technologies (Tryphon &Voneche, 2013). According to Tryphon and Voneche (2013), a student is exposed to a number of zones of proximal development (ZPD) in a classroom setting that occur at the same time, but at different rates. Research on the ZPD has included efforts to conceptualize teaching approaches, such as scaffolding, in response to the research that includes concerns that the value of this aspect of the theory has been misinterpreted in some instructional applications (Smagorinsky, 2017).

Vygotsky's (1978) socio-cultural theories are reflective of the idea that technology has a positive impact on student learning within and outside of the classroom. Implications of the theory include that children need a variety of compliments to learning, such as technology. The culture and environment in which they are taught impact the learning that will take place (Tryphon &Voneche, 2013). His theory on constructivism relates mainly to the internalization of social activity and mediation in the classroom. Vygotsky's beliefs suggest that teachers could use assistive technology in order to modify existing plans and activities in the classroom to enhance student engagement and increase opportunities for their application of symbolism and *outside-of-the-box* mediated and abstract thinking.

Vygotsky (1978) suggested that learning takes place when children interact through their surrounding culture, which is referred to as the socio-cultural theory. In essence, Vygotsky (1978) purported that individuals acquire an understanding of information from a process of collaborative elaboration or sharing with others which results in the construction of knowledge that non-engagement would not permit. Vygotsky also advocated that exposure to more knowledgeable individuals was advantageous for students to construct knowledge (Bhutto & Chhapra, 2013). Both theories of Piaget (1969) and Vygotsky refer to the assimilation of knowledge through encounters and measuring those encounters against previous experiences. Given the key concepts of the theory, creating a constructivist learning rich environment, infused with technology, would promote student engagement and academic achievement (Anfara & Caskey, 2014; Shabani & Ewing, 2016; Tryphon &Voneche, 2013).

Constructivism and the Learning Environment

The benefits of a technology-rich classroom environment extend beyond simply promoting cognitive thought that leads to improved academic performance. Environments focused on collaborative learning, differentiated instruction, and forms of flexible grouping that integrate technology have been found to promote students' self-esteem, socialization skills, motivation to learn, and reduced feelings of competition (Mata, 2015; Tomlinson, 2015). Students engaged in technology-rich environments have also resulted in the development of life skills. The integration of technology is a response to how students construct knowledge and the need for motivating them to become active participants in the teaching and learning process (Currie, 2016). However, researchers have cautioned that the integration of technology has to be effectively utilized, which involves the teacher providing feedback, but it can also be costly which prohibits integration in some school districts (Kardefelt-Winther, 2017).

In addition to some of the historical theorists' perspectives supporting technology integration as presented earlier (Piaget, 1952, 1969; Vygotsky, 1978), there are more recent works that support technology integration and the learner's cognition. Situated cognition (Brown, Collins, & Duguid, 1989) offers a more contemporary view of constructivist learning theory and its application to technology integration. Whereas the tradition views of the construction of knowledge link the environment and experiences to assimilating and accommodating new knowledge, situated cognition links the construction of knowledge to the context, activity, and culture in which it was experienced (Brown et al., 1989).

Situated Cognition and Constructivism

Similar to constructivism, situated theorists believe that students learn best when they are in an environment in which they are able to actively participate or engage in their learning (Brown et al., 1989). Implied for student learning relying on this theory is that technology integration into classroom instruction serves as a learning resource or assistive technology for students to help foster their cognition (Court & Janicki, 2016; Herodotou, 2017).These tools permit the active participation of students to construct knowledge through such activities as research and problem solving which involves reasoning about purposes, relationships, and resources needed to create or suggest solutions to a problem or situation (Greene et al., 2017).

Following the views purported in theories discussed, instructional practices would consider providing appropriate tools, artifacts, and resources that relate to the context of the situation studied and its relation to the physical world. The situation and accompanying resources would be at the crux of the interaction between learners. According to situated cognition, knowledge acquisition occurs within these resources and active interactions of learners with each other or within themselves (Brown et al, 1989). The use of technology facilitates this learning process through motivating learners and promoting problem solving (AVID Center, 2016).

The integration of technology in classroom instruction permits the teacher to personalize learning experiences for students. Surveys reported through the National Center for Education Statistics (NCES) show differences among teachers in the value of using technology in instruction. In one survey, Zweig et al. (2015) reported that teachers found engaging students problematic. They also found difficulty with student perseverance. In response to the difficulties, teachers indicated the need for structured professional development (Zweig et al., 2015). Other studies show that teachers find access to computers and other technologies beneficial for student learning. Technology has enabled teachers to personalize learning, reinforce and expand on content taught, and to address diverse learning styles of students (Gershon, 2017; Landrum, 2015; Wardlow, 2016).

The theoretical constructs of constructivism directly support the importance of integrating technology in classroom instruction for middle school learners. The results of some studies highlight disadvantages of the integration to include budgetary and knowledge limitations. The proposed study is designed to demonstrate the advantages of technology integration to include aiding the construction of new knowledge for both students and teachers, promoting success for students placed at risk of dropping out of school, and motivating learner engagement in the instructional environment. The study's results may reveal how dimensions of the theory can be included in specific strategies to reduce fear of technology; thereby, addressing the gap in terms of the teacher's ability to infuse accessible technologies in classroom instruction. In essence, this study may advance understanding of the theory's constructs such as active learning, constructing new knowledge, mental capacity, experiences, accommodation, and assimilation through providing suggested "how to" strategies focused on technology integration in the classroom.

Related Literature

In this digital era of the 21st Century, easily recognizable is that technology is evolving. The implication from this increased use in everyday society for teachers and school leaders, is that former routines, such as lecturing to students, are no longer effective (Wunische, 2019). This realization suggests that practitioners would find it practical to glean from the past those strategies and concepts that are beneficial and effective, but embrace the new concepts and best practices. In so doing, the focus would be on actions that would improve educational practices.

These educational decisions would be determined as a result of relying more on scientific practices recommended in the research literature than on personal experience (Gall et al., 2015). Guided by research on best instructional practices, the recognition that educators differ from their students, and knowledge of the main factors that influence the learning process, the result of these decisions would lead to amending many traditional models of teaching to incorporate more of the current trends in education. A trend in education is the integration of various forms of technology in classroom instruction (Posso, 2016).

Apparent from a review of technology advertisements and home shopping networks, many modern day students live in homes that are furnished with the latest technology devices, such as Kindle readers, tablets, computers, iPhones, iPods, laptops, and game technology systems. A review of publications, the Internet, and World Wide Web sites, including Facebook and Twitter, suggest that students know how to use and manipulate the various types of technology by engaging in them multiple times in order to video chat, play games, read, complete assignments, listen to music, and simply engage in a conversation verbally or by texting (Kardefelt-Winther, 2017).This realization suggests that it is logical to integrate technology in the classroom to improve students' overall averages as they improve their academic skills and abilities, which are accessed by class assignments, tests, quizzes, and standardized tests.

A recognized gap in the literature is that instructional practices need further study for addressing those students and teachers who are not motivated or self-driven to use technologies and engage in constructivists' strategies (Bouygues, 2019). Current practices in view of this need include professional development for teachers to prepare them for integrating technology resources in courses and programs in school settings (NCES, 2017). However, with the continuing emergence of technologies, there remains a need for developing skills and insights so that educators may create interventions that integrate the latest technology resources and gadgets that will assist in classroom instruction (Bouygues, 2019; Reboot Foundation, 2019).This review includes discussions related to the integration of technology in classrooms, forms of technologies, and their benefits. Among other topics included in the review are instructional practices that reflect constructivism with specific attention to the AVID program. The review begins with discussions of the need for using technology in classrooms based on factors contributing to students' academic performance and overall well-being.

The Need for Technology Intervention

Research has shown that technology permits interaction with one's surroundings and is viewed as a non-threatening and motivating tool to promote student learning in authentic learning environments (Wardlow, 2016). The need for intervention strategies to promote student learning is evident in national reports of student performance in reading and content areas (National Report Card, 2015).Further evident is the need to provide a stimulating environment and personalized instruction to promote learning. This evidence is also visible in state and national datasets of dropout and graduation rates (NCES, 2019).The need to improve the academic performance of elementary and secondary learners has resulted in the use of various strategies and technologies in classroom instruction, especially focused on mathematics and reading. Implied from reports of multiple strategies and differences in the performance of U.S. students and students in other countries (DeSilver, 2017), is that how knowledge is constructed for applying skills to improve reading performance is questionable. The research on high school dropouts associate various factors contributing to dropout rates, of which academic factors rank very high with performance in reading and mathematics being among defining academic factors. The research reveals various factors that may contribute to student learning. School and classroom factors include how students think they are perceived, their academic performance including scores on classroom assessments, their level of engagement in school events, school rules, behavior, and school attendance (McKee & Caldarella, 2016; Meškauskienė & Guoba, 2016; Ticuşan, 2015).These factors are also among those that influence students to drop out of school or to demonstrate undesirable behaviors that may eventually lead to school suspension.

There is agreement among some researchers in associating these factors with student learning and leaving high school. For example, agreement can be found that such factors as poor academic performance and school attendance, indicate the likelihood of students leaving school early (Campbell, 2015; McKee & Caldarella, 2016; Ticuşan, 2015).The results of literature review research led Ticuşan (2015) to conclude that student performance and school attendance are related and that causal factors of poor student performance and school absence were teachers, the family, and the student. According to Ticuşan (2015), mitigation of these factors would include establishing collaborative student-teacher relationships, and improving family-school relationships.

Researchers support Ticuşan's (2015) perspectives to include that improving the teacher-student relationship and student attendance involves the teacher's use of personalized instructional strategies and praise to recognize positive classroom performance. Meškauskienė and Guoba (2016) provided support to the perspective of teacher praise based on teachers' responses in a qualitative study of classroom assessments. The researchers found that teachers used praise as an informal assessment which enhanced students' self-esteem; thus, led to improved academic performance. Consistent with these researchers, a number of other researchers associate self-esteem, family demographics, and school demographics to student performance, or school dropout (Campbell, 2015; Garrett-Peters et al., 2016; McKee & Caldarella, 2016; Notlemeyer et al., 2015). Also, some of these factors are identified as student performance indicators, and have been shown to predict performance at later grades. According to McKee and Caldarella (2016), in a statistical analysis case study of middle school students, attendance, grade point average, D grades, and math scores on the American Collegiate Test were found to strongly predict students' performance in ninth grade.

The factors influencing student learning reported in this section of the review represent a small portion of a comprehensive list of purported factors. Reports in the literature tend to suggest that many authors accept that causes of poor academic performance and students dropping out of high school are established in the literature. However, there are recommendations in the literature for conducting additional research to identify causes other than the common connections that have been established in the literature (Campbell. 2015; Zaff, et al., 2016). Some researchers also suggest that factors may be better understood through investigating what happens to students after dropping out of school (Campbell, 2015; Garrett-Peters et al., 2016). Despite these varying views, the diverse factors cited in the literature imply the need for instructional and innovative practices to target students' diverse needs. The integration of technologies in the classroom is one avenue that can personalize learning and provide students additional avenues for constructing learning.

The Need and Societal Changes

The need for infusion of technology in teaching and learning environments has become more prominent with the current changes in human society. The COVID-19 pandemic has removed students and teachers from a physical classroom to a digital one. This movement is challenging and presents a greater challenge to individuals who have not remained abreast of various technologies and how to integrate them in instruction (Lior & Meirovich, 2020). Despite the challenge and ill preparedness of some teachers (Torcivia Prusko et al., 2020), educational institutions are commonly identified as facilitators of the transmission of academic knowledge and agents of cultural change. Lior and Meirovich (2020) observed that institutions must now create methods and content in view of changes created through COVID-19, and not rely on traditional approaches to online instruction.

In response to the need for new practices and uses of technology, Reimers and Schleicher (2020) created a framework to guide practice as a part of the Global Education Innovation Initiative at the Harvard Graduate School of Education and the Directorate of Education and Skills of the Organization for Economic Co-operation and Development. The 23-item survey was an inquiry to participating countries of their current global needs and practices for supporting the education of students at the basic levels during the pandemic. They used the results to create a Framework for Rapid Response to COVID-19.

Reimers and Schleicher (2020) identified online learning as a tool for delivering instruction under these circumstances because of its versatility and communication capabilities. The framework reflected recommendations collected through the survey completed March 2020. The following are among priorities based upon results of the survey:

> It is critical to facilitate teacher professional collaboration and learning, and to provide teachers with access to resources and online platforms for collaboration (technology and curated education resources) so they can keep abreast of the rapidly evolving challenges and the educational and social responses that are needed, and can support learning for their students in whatever modality of deliver is feasible, ideally online. Building partnerships between schools and higher education institutions might be a way to augment the capacity of districts and school systems to provide adequate professional development to teachers and to parents. (Reimers & Schleicher, 2020, p. 8)

The premise of the statements is reflected in the ways countries throughout the world are responding to deliver classroom instruction because of the pandemic. The scholarly literature and the media report various ways the United States and other countries are selecting to provide instruction (ALiHead & Lalani, 2020; Lior & Meirovich, 2020; Reimers & Schleicher, 2020). The majority of the 17 countries included in the survey inquiring of changes in teaching approaches, cited online learning as the major instructional delivery system (Reimers & Schleicher, 2020). Also, the majority of those citing online learning did not specify how or if there would be changes from traditional online methods. However, some countries have integrated online learning with television broadcasts and virtual classrooms. Invariably, practices include attention to professional development for teachers, resources in hard copy to students and parents, and creation of webinars and web pages to promote greater communication exchange (Reimers & Schleicher, 2020). Survey participants noted that the introduction of technologies and other innovative practices was a positive and unexpected result of school closures because of the pandemic.

The television as a teaching tool for families may be among the only technological alternatives available to some students. The stress on online learning leaves out those students who do not have computer access. For example, more that 30% of 15-year-old students in Indonesia do not have access to a computer in their homes or a quiet place to study (Reimers & Schleicher, 2020). This situation differs for Indonesia students at the college level where reports show they are knowledgeable of preparing for and engaging in the distance learning system during the pandemic, and they experience positive results of e-learning as an alternative learning process (Ana et al., 2019).

Online learning has been recognized as an effective instructional methodology; however, concerns have been raised because of the immediacy of its use among teachers who are not ready to implement instruction through this medium and because it represents a cultural change (Dignan, 2020: Holzweiss et al., 2020). Cultural changes suggest that online learning requires self-discipline (Martin et al., 2020). Often the student is provided a window of time to complete activities independently without the traditional arrangement where there is daily face-to-face contact with the teacher. Holzweisset al. (2020) conducted a case study of online students after a hurricane and found that among students' needs were assistance and time for adjusting to a shortened format for the course. Similar to COVID-19, these students were struggling with the aftermath of a hurricane.

In another study where students reported their perceptions of engaging in online instruction, they responded that they were less confident in time management and communication than in their technical competences associated with managing its structure (Martin et al., 2020). The shortened format and the online format in general imply that the use of time management and other study skills become essential for meeting submission times built into the online course. The online culture also includes that textbooks and other learning resources are digitized. Consulting these resources require reading from the computer screen or downloading for hard copies. Note taking may replace highlighting sentences in the traditional textbook. Learners and teachers not accustomed to the culture of online learning platforms may require more time to adjust to this instructional alternative.

Online learning, or e-learning, can be offered in various platforms. Commonly used platforms include Zoom, Google Meet, Google Classroom and Schoology. Some platforms have been in existence longer than others which suggests teachers may have used some features previously. Canvas and Blackboard have been commonly used to provide courses online. These platforms allow communication through email, Facebook, Twitter, and text. Video conferencing is another feature that can be integrated in a set of online instructional alternatives. Zoom is a platform that is familiar to television viewers as a result of COVID-19. A number of broadcasts are presented through Zoom. Goggle Classroom has updated features that include the following:

> Rubrics aim to make grading more transparent. G Suite will allow creation and grading based on rubrics through an early access in Google Classroom. Instructors can also use Course Kit to create rubrics and attach it to an assignment.
>
> Updates to Google Forms: Educators will be able to import questions that were previously used in new forms. Locked mode in quizzes will be enabled on managed Chromebooks.
>
> A new Grades page will be generally available so Google Classroom users can view and customize average games, share performance and set up grade categories. There's also

the ability to sync grades from Classroom to the school information system of record. (Dignan, 2019, para. 1)

Regardless of the features of the different online platforms, agreement throughout the literature can be found that the online teacher and student require a more targeted support system because *the classroom* now has a new culture with the world's current health crisis (Torcivia Prusko et al., 2020).

Technology Integration in Instruction

Changes in the needs of society and in schooling provide evidence of the need for integrating technology in classrooms (NCES, 2017). A review of missions and goals of school districts and states reveal an emphasis on their efforts is using research evidence to improve educational practices. Some federal mandates have influenced these efforts to include research-based practices (No Child Left Behind Act, NCLB, 2001). For example, the federal mandated NCBH (2001) required that districts apply objective and empirical methods in decisions about the use of programs and practices for enhancing student learning and to ensure that students were able to read at the proficiency level.

Improving educational practice guided through the results of the research suggests that among responsibilities of schools is in making learning more relevant and tailored for individuality and differentiated learning (Miles, 2019; NCES, 2018).The need to provide personalized instructional practices and the position that technology can facilitate such practices, are included in national and local technology reports that outline a plan of action for elementary and secondary schools (NCES, 2017). The technology plan that NCES (2017) contains specific objectives and action plans that support efforts to use technology integration to improve student achievement and help to prepare them for future academic and social success.

Various shifts and changes in the spectrum of education have occurred. Skills needed for the 21st century incorporate a wide range of digital tools and technology, which suggests changes in traditional ways of teaching (Herodotou, 2017). Among major changes from traditional instructional practices is planning instructional lessons around real-world concepts and using resources, such as technology, to which students can relate (Herodotou, 2017). In today's society, students are knowledgeable and advanced in using the latest technology available (Byrne et al., 2016; Kardefelt-Winther, 2017); therefore, applying this learner attribute can be instrumental in attempts to personalize learning experiences.

Making education relevant also suggests that practices are reflective of the differences students bring to the classroom. Students differ in their personality, learning style, ability, culture and community background; these differences are among some of the main factors that influence learning (McCann & Lawrence, 2015). A considerable part of the educator’s responsibility is amending instructional practices to account for these differences, utilizing the resources that are available to in order to keep students interactive and engaged, and planning lessons around real-world concepts and relative content (Miles, 2019). Historical and current research on technology infusion in the classroom shows that it may be challenging, but that teachers will find their lessons are more effective and will motivate student learning; thus student grades will improve when technology is used appropriately to foster learning environments for students (Reboot Foundation, 2019).

Examinations of the influence of technology on student learning have focused on various types of technologies and their uses. Technology has been associated with skill development as well as student behavior. Proponents of technology infusion in classrooms argue that since technology is a part of the lives of students outside of the classroom, the impact of classroom behavior and management would be a positive for teachers and administrators alike. This is not to say that teachers are not effective; however, the use of technology has been proven to assist teachers in many areas because of its flexibility. For example, technology permits teachers to expose students to environments and experiences through virtual reality. GAhn et al. (2016) demonstrated how virtual learning enables students to experience nature such as gravity or features of other planets. Additionally, the use of technology has been shown to improve students' communications and collaborative skills enabling them to work with their peers and teachers within the classroom (Reboot Foundation, 2019). Although the Reboot Foundation (2019) reported some findings revealing that students sometimes are off task when using some forms of technology which negatively impacts academic performance, other researchers report that students are more focused, and they perform better overall in their academics and social behavior given the age of the student and type technology infused in the instruction such as tablets (Berkowitz et al., 2015; Herodotou, 2017). Agreement can be found throughout the literature that the positive influences of technology infusion are associated with teachers' training and knowledge for selecting and using technology (Bouygues, 2019); sufficient professional development is also needed in order for them to feel comfortable and competent in using the various types of technological methods and instructional opportunities (Zweig et al., 2015).

Forms of Technology Infusion

The selection of technology for classroom use is dependent upon the reason for the integration. Instructors are guided in technology use through professional standards. The International Society for Technology in Education (ISTE, 2019) established standards for educators in their various roles such as leader or facilitator as they apply to guiding learning activities for students. The following three standards are organized in ISTE's Category 5, which describe expectations of technology use for the educator as a designer of learning activities:

- Use technology to create, adapt and personalize learning experiences that foster independent learning and accommodate learner differences and needs.
- Design authentic learning activities that align with content area standards and use digital tools and resources to maximize active, deep learning.
- Explore and apply instructional design principles to create innovative digital learning environments that engage and support learning. (ISTE, 2019, Designer, para.5)

The standards represent the basis or vision that the infused technology helps to facilitate. To further guide the decision for selecting the type of technology for a stipulated reason, ISTE (2019) includes conditions for the effective use of technology. An explanation is given for the list of conditions.

- **Shared vision:** There is protective leadership and administrative support from the entire system.
- **Access**: Educators have access to current technologies, software, and telecommunications networks.
- **Skilled educators:** Educators are skilled in the use of technology for learning.
- **Professional development:** Educators have consistent access to professional development in support of technology use in teaching and learning.
- **Technical assistance:** Educators have technical assistance for maintaining and using the technology.
- **Content standards and curriculum resources:** Educators are knowledgeable in their subject matter and content in the content standards and teaching methodologies in their discipline.
- **Student centered teaching:** Teaching in all settings encompasses student-centered approaches to learning.
- **Assessment:** There is continuous assessment of the effectiveness of technology for learning.
- **Community support:** The community and school partners provide expertise, support, and resources.
- **Support policies:** School and university policies, financing, and rewards structures are in place to support technology in learning. (ISTE, 2019, Essential conditions section)

Common technology integration formats include online and blended classroom learning, project-based learning, simulation gaming, web-based learning, mobile and hand-held devices, and the use of podcasts and videos (Kardefelt-Winther, 2017). Utami (2018) conducted a study to compare outcomes of seniors enrolled in a blended classroom with technology with those of students enrolled in a traditional class. Technology infusion included the use of the Internet, where students were provided materials for lessons, quizzes, assignments, and a discussion forum. Students followed learning activities provided on the web page in support of face-to-face learning. The results of this pre-posttest designed showed that the blended students' average pretest was 57.8, while the control group's average was 58.3. At post testing, the average of the blended group's performance outcome was 82.5 and the average for the control group was 72.9. The researcher concluded that the blended model was more advantageous for student outcomes than a traditional face-to-face model of instruction.

The value of gaming technology for motivating students, clarifying information, and preparing students for success has been noted in the literature (Kardefelt-Winther, 2017; Posso, 2016). Posso (2016) reported that engagement of 15 year old students in video gaming resulted in higher scores in mathematics, reading, and science. Educational gaming among different age groups has been positively linked with positive cognitive, motivational, emotional, and social development (Kardefelt-Winther, 2017). A vast majority of students already play video games and are proficient users of computers and gaming devices (Byrne et al., 2016), which implies that infusing educational gaming in classroom instruction is logical. Gaming technology is now commonly used and includes online educational gaming.

The multiple and diverse forms of technology enable infusion in creative, but meaningful ways. Among them is using the computer to search for information on the Internet, to display information visually, and to serve as a writing and study tool (Wunische, 2019). Advanced forms of the computer include notebooks or tablets (Posso, 2016). Software applications can be used to facilitate several functions where students may work independently and in groups, as well as help teachers assess students' work and maintain a record of progress. Other uses of technology infused in the classroom involve digital technology for creating websites or blogs using content management software such as WordPress, wireless digital microphones to enhance voice projection and clarity of communication; mobile phones and mobile applications to facilitate in and out-of-class questioning and feedback (Byrne et al., 2016); smart white boards permit illustrations of specific information the teacher intends for students to capture, to display visual images with the use of a projector; online streaming media including YouTube videos, and online study tools for expanding knowledge of mathematics and other content areas (Posso, 2016).

Problem-based learning (PLB) is another format for infusing technology in the classroom (Montoro et al., 2019). PBL is a student-centered instructional method in which students work collaboratively in groups to investigate and problem-solve real world problems through active engagement and use of critical thinking skills with the teacher serving as a facilitator (Yew & Goh, 2016). According to Yew and Goh (2016), PBL has been effectively used in educational, medical, and other fields. The process involves the student in self-directed learning while engaged in a collaborative setting. Among tasks in PBL is for the student to solve a problem through constructing knowledge in a process of connecting prior knowledge with resources that assist in making sense of the problem (Yew & Goh, 2016). Various forms of technology to include the Internet can assist the learner with identifying resources that are related to the problem being solved. In addition to the student using technology to solve a problem, technology has been incorporated in PBL as a framework for professional development and training purposes that promote active and group learning (Yew & Goh, 2016).

In many school districts, traditional textbooks and composition books have been replaced with modern 21st century technology such as smart phones, tablets, Kindle readers, video game consoles, iPods, and iPads. In a publication of the 2017 National Education Technology Plan Update (NCES, 2017), the writer refers to the update as the "vision and plan for learning enabled by technology" (p.3). The plan is based on previous findings of the status of technology use in schools, and sets an agenda for change. Acknowledged in the publication, is that as a tool for transforming learning, technology can bridge the gap in the academic divide, facilitate approaches to learning and collaboration, and facilitate approaches to meeting the diverse needs of all learners. In essence, the Plan Update (NCES, 2017),is intended as a technology-driven initiative designed to pave the way for many students of all academic stages to be actively engaged in the subject matter. Integrating technology in the classroom entails making technology a resource for the enhancement of content (NCES, 2017).

The concept of resources and practices interrelated within routine lesson plans and involve various types of software, digital technologies, and any other types of equipment or apparatus for networking and communicating virtually, are considered technology (Kardefelt-Winther, 2017). In addition to formats for infusing technology previously discussed, technology-infused practices are included in cooperative group activities and sessions, Internet-based activities, as well as network-based transmission and retrieval of information (Currie, 2016). Technology-infused practice is another avenue for efficiently and effectively supporting school missions, objectives, and goals and for the differentiation of instruction (Tomlinson, 2015).

Another commonly infused technology in instruction is the student response system, clickers. Clickers, wireless handheld response pads, transmit a response to the teacher's question to the teacher's computer. There is wide spread use of clickers among educators and are effective for immediately tracking students' responses (Landrum, 2015). As new technologies have emerged, clickers can be used as an application on a tablet or smart phone whereby the student's response is transmitted through the Internet to the teacher's software. A number of laboratory and classroom studies have been conducted to assess the effectiveness of clickers on student performance. In some of these studies, teachers acknowledged that clicker technologies can be an effective, as well as excellent resource for integrating instructional technology in the classroom and for changing students' attitudes about engaging in the learning process (Landrum, 2015).

Landrum (2015) reported results of laboratory studies that revealed such benefits of clickers as enhanced student performance and instructional time. Findings revealed that because of immediate feedback on what students did or did not comprehend, instructional time was more effectively used. Similarly, classroom studies revealed enhanced student performance, but in some cases, there were minimal improvements in students' test scores. Landrum also reported that students' performance improved when "clicker use was made non-anonymous in a classroom-based study" (p.251). Although some studies of the effectiveness of clicker use show varying degrees of effectives and some mixed reaction, studies of the impact of its use on other variables suggest that overall, the use of clickers is effective for promoting student performance. Variables such as engagement and school attendance have been conducted with respect to clicker use. Conclusions from these studies show that clickers encourage active engagement as their use can protect the anonymity of the responder as opposed to students identifying an answer by raising hands, and this active engagement results in better school attendance (Landrum, 2015).

Consistent findings from clicker research spanning from the early 2000s to currently show that the behavior and attitudes of students changed when instruction involved technologies such as clickers. Students' attitudes about learning and receiving the information positively changed. However, after a review of the literature that included students' perceptions and performance in 66 studies of clicker use, Landrum (2015) proposed evidence-based recommendations for clicker use in classrooms. These were for educators to carefully consider the use of clickers as one component of their instructional practices and to consider practical applications of their use beyond measuring student performance. Landrum stressed using clickers for promoting interactions among students and teachers, and for stressing students' critical thinking skills. The author indicated that such conclusive data from using clickers should have a significant impact on educators choosing other pedagogical approaches and instructional methodologies.

Researchers acknowledge that integrating technology in the classroom or using particular forms of technology is not always the teacher's decision. Smith (2017) suggested that even though teachers do not choose curriculum alone or choose the guides and outlines, they still make their own instructional decisions. Smith addressed autonomy in decision making and strategies for collaborating that involved using technology as in the following:

> Sometimes administrators cite teacher input in a scripted curriculum as evidence of the "collaborative" nature of this approach. But when teachers are expected to adhere to restrictive guidelines, they will inevitably suffer the burnout of bureaucracy. Educators who are subjected to this bureaucracy can become exhausted while trying to implement tools, scripts, and lessons that they don't necessarily agree with or understand. This loss of autonomy signifies a lack of respect for teachers. As experts of our own profession, teachers must take an active role in balancing the need to make choices based on our own expertise with the positive effects of collaboration. . . . Technology makes connecting with like-minded individuals . . . possible. (Smith, 2017, para. 6)

From this review of technology infusion and efforts of school districts o promote students' success, when it comes to choosing resources that will most benefit students in the 21st century, many districts and teachers have chosen technology as the center of their instructional advances.

Given the benefits of technology (Kardefelt-Winther, 2017), this choice purports the possibility of students achieving maximum results in the areas of critical thinking, reading, problem solving, and student constructed responses within the classroom. For example, resources are provided to teachers that are necessary in order to engage their students while using a variation of Internet programs, online texts, websites, and software for critical and meaningful learning experiences (Tomlinson, 2015). As a results, educators would make the technology available for students to utilize while improving their critical thinking, analytical skills, self-modification, greater levels of literacy and skills, and critical problem solving skills (Greene et al., 2017; Wright & Cervetti, 2017).

Benefits of Technology Integration

Assessments of the use of computers and other technologies in classroom instruction show a positive impact on both teachers and the students when used appropriately (Bouygues, 2019; Kardefelt-Winther, 2017; Reboot Foundation, 2019). Appropriate use of technologies is enhanced through teachers receiving sufficient professional development in order to feel comfortable and competent in using the various types of technological methods and instructional opportunities with their students (Reboot Foundation, 2019). Technology such as computers and tablets are frequently used as the medium for students to complete assignments and its use encourages more on-task learning (Herodotou, 2017). The research supports that technology is beneficial for tailoring instruction to the needs of students, promotes student achievement, especially in mathematics; has a positive impact on children's mental well-being and their social relationships (Kardefelt-Winther , 2017).

The Internet has also been a focus of discussion regarding benefits of the computer in classroom instruction (Byrne et al., 2016; Posso, 2016). Posso (2016) reasoned that the computer and Internet have been life changing in information explosion and exchange. Through the Internet the level of communication increases and it provides opportunities for one to find and analyze information (Posso, 2016). This function of the computer along with the Internet is directly related to objectives of teaching and learning in the classroom. Montoro et al. (2019) suggested that integrating computer technology in the classroom benefits students through promoting active engagement in learning, retention of information, and increases in skills needed for processing and sharing information.

Researchers who have studied students' behavior while engaged in technology-infused learning environments (Akhtar et al., 2017; Montoro et al., 2019; Zheng et al.,2016) purport that integrating the various technological resources in the classroom helps students develop analytical and critical thinking skills and improve their overall performance. An Internet search of school websites showed that numerous school districts in the United States have been exploring the many options of technology in an effort to help students with cognitive and processing skills. Effective technology integration is achieved when it is used to support curricular goals and objectives in subjects like reading, which is where students will need to know how to identify the plot, analyze the text, decode, translate, infer, draw conclusions, comprehend, and process the information that is required (Wright & Cervetti, 2017). Technology tools such as E-Reading technology are used to support reading comprehension skills in the classroom and can be effective in relation to improving students' overall averages in reading (Kardefelt-Winther, 2017; Posso, 2016). Another type of technological resource that has proven to be effective is the smart technology clicker device, also known as clickers cited earlier in this review. Effects of implementing clickers have helped to engage students in the learning environment through offering them a non-threatening approach for responding to their instructional needs (Landrum, 2015).

Student Motivation and Technology

Encouraging students' interest in learning has been a constant concern for educators throughout the history of formal education in the United States. This encouragement is needed because of a number of contributing factors including gender, age, ethnicity, socioeconomic status, cultural backgrounds, the school, academic performance, socialization, affective factors, and technology as an instructional methodology (McCann & Lawrence, 2015). An obvious position in the motivation literature is that motivation leads to enhanced learning and retention (Murayama, 2018).

The literature also reveals that positive motivation is a result of different influences. Theorists, such as Bandura (1977), suggest that motivation is related to one's self-efficacy or confidence in one's abilities, a form of intrinsic motivation. Other authors cite gender and subject matter as accounting for a great deal of the difference in what and how of motives. For example, McCann and Lawrence (2015) reported findings from the literature that suggest boys are more motivated from the content of mathematics and science than girls, whereas girls are more motivated from the content of writing and the language arts. The researchers acknowledged the relation of these motives to stereotyped views of the roles of males and females that may be influenced by the home, school, community, and society.

McCann and Lawrence (2015) conducted a descriptive quantitative study to determine relationships between the age, sex, and ethnicity on high school math students' motivation and learning strategies. A convenience sample of ninth grade students in Kentucky responded to the Motivated Strategies for Learning Questionnaire. Findings revealed that differences in motivation based on the grade level of students and differences in learning strategy differed on the student's gender and grade level (McCann & Lawrence, 2015). Higher mean scores were found on motivation for learning for students over age 14 years; the strategies for learning scale also resulted in higher means scores for students over 14 years of age (McCann & Lawrence, 2015). The researchers concluded that age and maturity influence motivation.

Motivation is also associated with interest, curiosity, rewards, and competition (Murayama, 2018). Other studies have linked student motivation to instructional strategies that include the use of technology. The technology-infused instructional strategy responds to student curiosity, interest, rewards, and competition. Several studies have concluded that students are more motivated and perform better academically when they are taught by teachers who integrate technology during instruction, as well as when teachers allow students to use technology resources (McCann & Lawrence, 2015). During the 21st Century with the various types of technologies equipped in homes, families have made it easier for students to find relevancy to the use of modern technology. This provides an advantage to educators in integrating technology that students have already been exposed to its use.

Gaming technologies are sources of motivation for promoting student engagement in the learning environment (Reboot Foundation, 2019). Digital game-based learning (DGBL) has been employed in different content areas and had been found to promote student performance in mathematics and the sciences (Bouygues, 2019; Kardefelt-Winther, 2017). According to Kardefelt-Winther (2017), there are mixed reports on the influence of technological gaming on students. For example, Bouygues (2019) reported that high usage of educational games for reading results in poorer scores, especially if the technology is used as the basis for instruction. Other studies show that reading improves based on the purpose and content focus of gaming and other technologies (Bouygues, 2019; Reboot Foundation, 2019).

Some studies reveal that students' engagement in video gaming results in positive influences on their cognitive, motivational, emotional and social development; while others reveal that excessive engagement has a small negative effect (Kardefelt-Winther, 2017). Although gaming technologies show beneficial effects on student learning, the age of students and time spent on computer or gaming screens has been a concern with respect to children's development (Bell et al., 2015; Herodotou, 2017; Przybylski, & Weinstein, 2019). Kardefelt-Winther (2017) reported that there may be a small negative impact on children's well-being when they engage excessively in using digital technologies, but when the time spent is moderate, there may be a small positive impact. However, Przybylski, and Weinstein (2019) concluded that empirical evidence for determining the association between screen time and children's well-being is limited.

Constructivism Applied to Reading Knowledge and Performance

Although school learners at different grade levels have unique developmental characteristics, descriptions of developmental characteristics and learner needs are the same (Piaget, 1952, 1969). These categories include physical, social-emotional, and cognitive. The research in classroom instruction typically focuses on cognition with regard to academic performance; however, forms of digital technology infused in instruction have enhanced all of these characteristics (Dinçer & Doğanay, 2017). Instruction is further emphasized in relation to students' reading performance at local, state, and national levels. Recognized is that the achievement of students in the United States lags behind that of students in many other developed countries to include performance in reading (DeSilver, 2017). Therefore, a number of strategies and innovative programs have been developed to focus on improving students' reading performance at the elementary and secondary levels.

Reading comprehension and vocabulary skills are characteristically underdeveloped among many middle school students which often results in the description of struggling readers (Lervag et al., 2018). Poor reading achievement in vocabulary is associated with complex knowledge and skills specifically identified for expressive language and include grammar, the ability to identify prefixes and suffixes, and apply phonetic analysis to articulate the pronunciation of words (Mirzaei et al., 2017; Spencer et al., 2015). Poor performance in vocabulary depth and breadth is associated with difficulties in understanding concepts and meanings in different content areas (Mirzaei et al., 2017; Güngör &Yaylı, 2016).

Conclusions that were indicated from a meta-analysis of the review of literature support that attention to students' construction of reading knowledge involves selecting and using strategies to which students can relate and providing opportunities for developing quickness in word recognition (McLaughlin & Rasinsk, 2015). This translates to the infusion of technology and other strategies that facilitate quick and repeated exposure to vocabulary used in different contexts and associated ways to comprehend the material (Swanson et al., 2017).

Research has shown that students' performance in reading, writing, and mathematics improves when technology is effectively integrated within classroom instruction (Bouygues, 2019; Kardefelt-Winther, 2017). The research also shows that the effective integration considers the age group, type of technology used, the content area for which it is used, and the duration that students are engaged in its use. For example, a report of the Reboot Foundation (2019) revealed that students performance differed based on instructional time when using the computer. Long periods of computer instruction were associated with lower performance than short periods of instruction. Performance also differed based on the type of digital tools used such as games and tablets.

The Reboot Foundation (2019) used assessment data from over 90 countries included in the Program for International Student Assessment (PISA), and data from the United States included in the 2017 National Assessment of Educational Progress (NAEP).The Foundation also collected data from students who self-reported their use of different technologies, including the Internet, and time spent for studying and in-class instruction. Although there were some differences in findings from the analysis of the PISA and NAEP data, there were trends common to both. These included that digital tools (a) do not appear to work well for young children learning to read, (b) can have a positive impact when used for immediate instructional feedback, and (c) promote richer thinking when used with older students (Reboot Foundation, 2019).

Findings specific to the United States varied and depended upon such variables as grade levels and the technologies. Positive outcomes were associated with reading performance based on the use of computers for specific types of projects completed. Evidence of positive outcomes was limited for the use of computers and performance in skills such as spelling (Reboot Foundation, 2019). The use of tablets among fourth-grade students who relied on them for most of their classes resulted in lower reading exam scores than those of students who did not use tablets. Although the study's findings supported prior research in acknowledging that technology can improve learning outcomes, the limitations of the study included that relationships found did not indicate causal relationships.

An examination of the 2019 NAEP data (Bouygues, 2019) revealed similar findings as the study of the 2017 NAEP data. Bouygues (2019) examined state data along with responses of students and teachers across the United States. In the comparative analyses, Bouyguess cited such states as Rhode Island, Arkansas, Missouri, and the District of Columbia. The analysis also compared student performance by grade, content areas, and types of technology. Variables also included usage time reported in days and hours, and the context of usage. The context referred to whether the technology was in the classroom, teacher-directed, used to supplement instruction, or used independent of these contexts.

The study's findings reflected students' self-reported usage of forms of technology, including forms of digital technologies the reading performance of students in reading who used the computer for no more than 30 minutes daily for English language-arts, was more than 20 points higher than students who used the computer four or more hours daily for the same content area (Bouygues, 2019). Reading performance based on the use of tablets showed a gap in scores that ranged from a low differential range of 15 points to high differential rage of 38 points. The 15-point differential occurred among fourth grade students who responded to a survey using Likert-scale items such as *all, or almost all,* and *never* (Bouygues, 2019).

Respondents in Georgia indicating *all, or almost all,* use of tablets in their classes scored 15 points lower than those reporting the use as *never.* The trend of the higher use of tablets, the lower the reading performance was found for most states. Bouygues (2019) reported that the performance gap was larger in other states. For example, the reading performance score of students who used tablets in all or almost all of their classes scored an average of 26 points lower than students who never used them in the states of Arkansas, Missouri, and the District of Columbia (Bouygues, 2019). However, the point differential was 38 for fourth grade students in Rhode Island.

The analysis for mathematics yielded similar results. Negative relationships were found when comparing the use of computers or digital devices for enrichment activities and research in mathematics among fourth grade students (Bouygues, 2019). A 5-point decrease in math scores was found when students reported that they used the computer or digital technologies in school *a lot* to practice or review math (Bouygues, 2019). Similar results existed for different types of technologies including reading-related applications, electronic textbooks, and laptop computers. Lower performance scores were associated with greater usage of educational games, electronic textbooks, and reading applications.

The researcher recognized limitations of the study to include the nature of data for the correlation. Also acknowledged was that the relationship between student learning and classroom technology is complex (Bouygues, 2019).Therefore, the findings did not substantiate that the use of the technology caused the outcomes. Conclusions included that there are apparent benefits of technology use for instructional purposes; however, these benefits decrease with the increased use of such technologies as computers and tablets. Therefore, the usage time and the nature of the content should be among considerations in instructional decisions regarding their use. Bouygues (2019) noted the need for additional research to determine the influence of technology on student learning.

Other studies report similar observations of the affects of technology on student performance (Berkowitz et al., 2015; Zhang et al., 2016). However, the literature contains mixed results of technology based on its use. Generally observed is technology usages are a part of the lifestyle in society and as forms and uses of technology increase, so does the research about these forms. As technology has taken a prominent place in homes and learning institutions, reports of their effectiveness and ineffectiveness have emerged world-wide (Zhang et al., 2016).

The desk-top and lap-top computers are traditional forms of technology used in classrooms. However, forms of digital technology, tablets for example, are now also commonly used in instructional settings (Kardefelt-Winther, 2017). In general, findings reveal a positive relationship between the use of computers and digital technologies, as well as student performance when used appropriately (Kardefelt-Winther, 2017; Reboot Foundation, 2019). Results of studies also show that the effectiveness of their use is limited based on the length of time students use them. A shorter duration results in higher performance scores on measures in reading and mathematics than a longer period of use (Bouygues, 2019; Kardefelt-Winther, 2017). Posso (2016) reported that the Internet usage among 15 year old students had a negative influence on their achievement in mathematics, reading, and science. Students' engagement in educational types of video gaming resulted in higher scores within content areas.

Exploring the Gap

Reports in the literature invariably report the positives related to infusing technology in classrooms. However, results of surveys with teachers underscore the need to address the lack of effectively integrating technology (Reboot Foundation; Zweig, 2015).This problem includes the hesitancy on the part of some teachers to break away from the traditional information dissemination, which is often accompanied with computer use, the lack of computers and other technologies in some school districts, and the need for professional development focused on technology infusion. The trend for needed teacher professional support and more technological devices in the classroom is shown in various reports that NCES releases. For example, surveys as early as 1999-2000 revealed that teachers without professional development did not feel prepared to use technology (Gray et al., 2010).The level of preparedness increased based on the number of hours teachers engaged in professional development. The survey also revealed that 40% of the respondents indicated that they used computers often in instruction, but also required more access to technologies.

In addition to technology use varying based on teacher training, NCES (Gray et al., 2010) showed differences in technology use and access for classrooms according to school characteristics. The differences included location of the school, urban as opposed to rural, school poverty level, and school size. Differences also existed in the application of the technologies. The trends of needed training and needed technologies are evident in surveys completed in the United States and abroad. Vassallo and Warren (2018) also found teachers' use of technology differed based on experience, school location, and student age. The more experienced teachers integrated technology. Similar to the current literature, preparing written reports and practicing basic skills have been associated with the highest percentages for using computers and the Internet in classroom instruction (Gray et al., 2010; Reboot Foundation, 2019; Vassallo & Warren, 2018).

These trends suggest that strategies are still needed to address the gap in both teachers having access to various technologies and in their effective use in the classroom. The AVID program is one avenue for helping to address this gap, especially in terms of the teacher's ability to infuse accessible technologies in classroom instruction.

The AVID Program

Advancement Via Individual Determination (AVID) is a nonprofit program that is designed to assist schools in closing the opportunity gap among all learners so that they may prepare for college, a career, and life. AVID’s college and career readiness program features nine core strategies: collaborative structures, collaborative study groups, family engagement, focused note-taking, higher level thinking, organizing materials, philosophical chairs, relationship capacity, and Socratic seminar (AVID Center, 2020). Mary Swanson developed the program in 1980, designed to address the academic, social, and emotional needs of Hispanic students who were underperforming (AVID Center, 2020).

The framework for the AVID program focuses on promoting rigorous content and instruction that will exemplify its four domains: instruction, systems, leadership, and culture within schools. A team of volunteer educators and stakeholders actively work to promote the vision and tone of college readiness and high expectations for all students by using the Coaching and Certification Instrument as a tool to assess the individual programs within schools. The program also calls for tutoring as an essential component along with the provision of adequate resources, and teaming as an instructional approach (AVID Center, 2020).

Currently, AVID is implemented and taught in over 7,000 schools across the United States, to include schools within the Department of Defense Education Activity, Canada and Australia (AVID, 2020). According to the official website for Advancement Via Individual Determination, AVID announced in January of 2019 that the program's Digital Teaching and Learning training was awarded the International Society for Technology in Education Seal of Alignment. Because educators are teaching in the 21st century with technology all around, it is imperative that teachers understand how to use the latest technology in the AVID classrooms. The new Digital Technology Learning (DTL) training is designed to assist teachers assess which technology resources will best fit their classroom instructional needs for teaching and student learning. The teachers will also receive instruction as to how to use the technology resources. AVID professional development entails the various content areas for elementary through high school. The teacher training descriptions include topics such as Cultural Relevancy Teaching, Academic Language and Literacy, and Digital Teaching and Learning (AVID Center, 2020).

Summary

This research was framed in constructivism theory**.** The need to motivate students for engaging in learning is apparent in the high rates of high school dropouts, low graduation rates, and the length of time some students remain in school before graduating (Stark & Noel, 2015).

Learning theories provide guidance in identifying approaches to address this need. Several studies and reports in the literature illustrate the importance of focusing instructional practices on the characteristics of students, their needs, and the way they learn (Miles, 2019; Tomlinson, 2015; Wunische, 2019). Instructional innovations that employ various technologies are among constructivist strategies targeted to learners' needs. The following sections contain reviews of the literature regarding characteristics of students, the needs of students, factors influencing their academic performance, and innovations designed to improve their ability to construct knowledge.

There are many students who desire to do well, but may need the extra boost or movitation. School district leaders, principals, and teachers are discovering more and more that students are exposed to the latest technology gadgets in their daily experiences. Not only do students live in homes that have the 21st century technology, but many of them have mastered the concepts in order to use the technology. Many of these same students may not have the opportunities to be ready for college. These students are usually the first generation college students. Conventoinally, these students would be a part of a group of students who are considered under-represented upon their entrance into higher education.

At the secondary level, AVID helps to prepare teachers and coordinators with the resources that they require for assisting students on their path to becoming college and career ready. It is for this reason that many educational programs, school leaders, and teachers have implemented the use of the latest technology gadgets into their 21st century schools and classrooms.These school leaders and educators have seen the positive effects that integrating technology for instructional purposes has on students not just behaviorally and socially, but academically. Although this review has shown positive influences of technology infusion, the need arises to determine aspects of the AVID or other interventions that help to ensure teachers and students can profit from a construstivist environment infused with various technologies.

CHAPTER THREE: METHODS

Overview

The appropriate infusion of technology in classroom instruction has been shown to offer benefits to student learning. However, with the array of technologies available, it is important that school leaders and teachers have scientific knowledge to base decisions on the selection and application of technologies. The purpose of this research was to determine whether the performance of groups taught through an integrated technology approach in the AVID program significantly differed from groups who were not in the program and to suggest possible causative factors associated with performance differences. This chapter is composed of discussions for the following topics: Research Design, Research Question, Hypothesis, Participants and Setting, Instrumentation, Procedures, and Data Analysis.

Design

This quantitative study employed a causal-comparative design. Causal-comparative research is also referred to as ex post facto research. The design is used to determine relationships between variables and whether the independent variable influenced the dependent variable (Mills & Gay, 2019). The design is appropriate for seeking relationships between two or more groups that differ in some aspects and are compared on other variables (Mills & Gay, 2019). Characteristics of the design include that participants are not randomly selected and assigned as comparison groups, and there is not a manipulation of independent variables (Mills & Gay, 2019). The selected design was appropriate for this study as archived data were used. Therefore, any manipulation or actions related to the variables had already occurred (Creswell, 2014). Also, the design is cost-effective as it does not involve the time and resources as compared to experimental research.

In this study, the two groups for comparison were the Advancement Via Individual Determination (AVID) program and the Non-Advancement Via Individual Determination program. The two groups (AVID & Non-AVID) representing the independent variables were compared on

PSAT performance mean scores (dependent variable). Differences in the instructional approach described the groups. The independent variable was defined as the type of instruction provided: AVID and Non-AVID. AVID is a college and career readiness program that encourages the use of technology and features nine core strategies: collaborative structures, collaborative study groups, family engagement, focused note-taking, higher level thinking, organizing materials, philosophical chairs, relationship capacity, and a Socratic seminar (AVID, 2020). AVID instruction incorporates computers/digital technologies as major instructional tools in daily instruction and other specialized support features (AVID, 2016). Non-AVID instruction is referred to as the traditional classroom that may include some use of the computer. Comparisons of the groups were based on test scores; therefore, the causal-comparative design was designed to seek possible causes of differences in the performance scores.

Research Question

This study intended to determine differences in performance scores through addressing the following question:

RQ1: Is there a difference between the total performance mean scores of groups in Advancement Via Individual Determination and performance mean scores of groups in Non-Advancement Via Individual Determination in middle schools as measured by the Preliminary Scholastic Assessment Test?

Hypothesis

The significance of the influence of the independent variable on the dependent variables was determined through testing the following null hypothesis:

$H_0$1: There is no statistically significant difference between the mean scores on the Preliminary Scholastic Assessment Test for Advancement Via Individual Determination groups and Non-Advancement Via Individual Determination groups in 15 middle schools.

Participants and Setting

The participants for this study were purposely drawn from a targeted population of middle school groups in large urban school districts in Texas. The estimated population represented Caucasian (15%), African American (40%), Hispanic (40%), and Asian (5%). The population at the sites represented groups from low to medium income families. About 80% of the groups qualified for free or reduced meals. The 15 schools comprising the AVID group represented average PSAT scores from an archived sample of middle school groups for the 2016-2017 academic school years. The projected sample size of 120 (60 AVID and 60 Non-AVID) exceeded the minimum of 100 when assuming a medium effect size, statistical power .7, and alpha level of .05 (Gall et al., 2015). Both groups of students (AVID, Non-AVID) had taken some type of standardized test as fifth graders.

The impact of COVID-19 on schools prohibited authorizing personnel in the district from providing the population archived data that would have included data for more demographic comparisons. Therefore, archived data representing frequencies and percentages were obtained through the AVID website for the schools in Texas. The data did not permit identifying PSAT scores by the number of males and females or by individual raw scores represented in the groups. Therefore participant data were limited to the gender of test takers by percentages and PSAT scores by average group means. Schools as participants were selected to purposely have as closely matching data characteristics in both groups as possible on the percentage of PSAT test takers.

Instrumentation

This study used test results available to the researcher in the form of archived data. Performance measures were based on results of the Preliminary SAT (PSAT) administered in middle school by the eighth grade. The College Board typically administers the test at schools during the school day. The test is administered for 2 hours and 45minutes for measuring skills in math, reading, and writing. The reading and math sections are multiple choice items and the writing section is an essay. Each of these sections is timed. The reading and math sections contain 47 items each, and the language sections contain 44 items. Students' responses are scored one point for each correct item and converted to the scale score that ranges from 160 to 760. The composite score for all of the sections, including an essay, ranges from 320-1520, according to Kaplan (2019).The test is considered a practice test for the Scholastic Assessment Test (SAT). The test is a standardized instrument of the College Board and whose psychometric properties have been established through studies and administrations.

The 1997 manual for the American College Test reported internal scale score reliability estimates for the sub-scores of mathematics, reading and writing that ranged from .71 to .85. However, more recent reliability studies on the total test for both forms of the assessment indicate internal consistency estimates of .93 for critical reading, .92 for mathematics, and .83 for writing. Reliability estimates were similar with.88 for critical reading, .91 for mathematics, and .80 for writing (College Board, n.d).

Procedures

Permission to conduct the study was acquired from the Internal Review Board of Liberty University. Requests from the authorizing officials of the districts selected for the study were prohibited due to the COVID-19 pandemic. However, the request followed guidelines of both the institution and the district. The request was emailed to the districts' research department or authorizing personnel. The communication included the purpose of the study, the data needed, assurances of the protection of the identities of the schools, and a request for an interview, if needed, to provide any other information about the study. The study used archived data; thus, site permission requested the use of the databases containing the demographic and test data needed for analysis.

Although the districts did not provide the databases, data from the AVID Center were used to answer the revised research question. Data needed to answer the research question and test the hypothesis were downloaded onto a personal computer. Data stored on the computer were only accessible to the researcher. An access code helped to ensure the confidentiality of the data. The data were coded for analysis and prepared for entry to a version of the Software Package for the Social Sciences (SPSS). All data containing the names of schools used in the study will be destroyed according to the time period established through the university's IRB.

Data Analysis

An independent samples *t* test was run for the analysis of data from mean scores of the PSAT as the dependent variable of the study associated with the hypothesis posed for the study. AVID and Non-AVID constituted the independent variable for the hypothesis. The *t* test statistic was appropriate for testing for significant differences between the means in two unrelated groups (Warner, 2013). The test was also appropriate as there was one independent, categorical variable that had two groups (AVID/Non-AVID) and a continuous (total PSAT scores) variable (Warner, 2013). As recommended in research methodology, prior to applying any statistical analysis, the PSAT scores were screened for outliers (Green & Salkind, 2014). The datasets of PSAT scores for each group were sorted in ascending order and scatter plots were used to identify outliers and scores that were unusually different, or extremely higher or lower than other scores (Green & Salkind, 2014). According to Warner (2013), knowledge of the variables and the range of scores, and whether the score is likely legitimate or a recording error are among considerations for the removal of high or low values or outliers in the data.

Data were uploaded in SPSS for analysis through descriptive and inferential statistics. The descriptive statistics identified the average performance of the two comparable groups (AVID/Non-AVID) on the PSAT score and the spread of scores around the mean (the standard deviation). The analysis determined if there was a statistically significant difference in the PSAT means scores of AVID and Non-AVID groups. Typically, the 0.05 alpha level determines statistical significance and whether to reject or accept the null hypotheses. To avoid a Type 1 error or the possibility of a false-positive result for the alpha set in hypothesis testing of multiple comparisons (Warner, 2013), Bonferroni correction is advised. However, multiple comparisons as proposed did not occur in this study. Therefore the 0.05 alpha level was established for the single *t* test.

The application of tests in the analysis of data was based on meeting their assumptions. The *t* test requires that there is one independent, categorical variable that has two levels or groups and one continuous dependent variable (Warner, 2013). To determine whether the dependent variable was normally distributed within the AVID and non-AVID groups, the analysis included running the Shapiro-Wilk test to examine assumptions for a *t* test of normality (Warner, 2013). The procedures allowed for running the Mann-Whitney U test in the event normality was violated through either group's data not being normally distributed (Warner, 2013) and for a test of equality to determine whether the variances of the two groups were equal in the population. The effect size (small, medium, large) of the difference between AVID and non-AVID groups was determined through calculating Cohen's D, an appropriate measure, but more effective when the sample size is greater than 50 (Green & Salkind, 2014; Stephanie, 2015). All statistical analyses were run through SPSS.

Summary

This section of the document included the procedures for conducting this quantitative study designed to determine whether the performance of groups taught through an integrated technology approach in the AVID program significantly differed from that of groups not in the program. The causal comparative research design was chosen to suggest reasons for any differences that existed between performance scores on the PSAT and the two groups. A purposive sample selected from archived data consisted of 15 schools with AVID and Non-AVID middle school groups.

CHAPTER FOUR: FINDINGS

Overview

The purpose of this causal-comparative research study was to determine whether the performance on the PSAT differed between groups taught through an integrated technology approach in the AVID program and groups not in the program. Performance differences were measured for groups of scores for a sample of middle schools in Texas. Difficulties associated with the COVID-19 pandemic prevented the availability of PSAT raw scores to enter in the analysis. Data for the study were acquired with permission from the AVID Center AVID Report Site, MyAVID Professional Database for Educators, Teachers, and School Counselors. Therefore, as the data from the AVID Center excluded frequency counts to identify individual performance scores, the test for the hypothesis relied on an examination of data points for each treatment representing the average performance scores for AVID and Non-AVID programs in 15 middle schools. This chapter reports the results of the descriptive and inferential analyses of the data.

Research Question and Null Hypothesis

RQ1: Is there a difference between the performance mean scores of groups in Advancement Via Individual Determination and performance mean scores of groups in Non-Advancement Via Individual Determination in middle schools as measured by the Preliminary Scholastic Assessment Test?

$H_0$1: There is no statistically significant difference between the mean scores on the Preliminary Scholastic Assessment Test for Advancement Via Individual Determination groups and Non-Advancement Via Individual Determination groups in 15 middle schools.

Descriptive Statistics

The study compared a cross section of PSAT scores in middle schools, and a cross section of districts in the same state to acquire an understanding of the performance of AVID and Non- AVID groups within a single state. Ultimately the comparison was designed to determine which group within the schools and which group within the districts performed better on the PSAT. Archived data for the school term 2016-2017 (AVID, 2017) included descriptive statistics for AVID and Non-AVID groups for 15 middle schools in the state of Texas. For this period, by eighth grade 29% of middle school AVID groups in Texas had completed the PSAT compared to 20% of Non-AVID middle school groups. Of these percentages, Hispanic or Latino populations represented the largest ethnic group in the AVID data (61% versus 55% Non-AVID). There was a higher percentage of females in the AVID groups than Non-AVID groups (59% versus 49%), and a higher percentage of males in Non-AVID groups than AVID groups (51% versus 41%). Also, demographics for the 15 schools mirrored those of the state.

PSAT score analyses for Research Question 1consisted of 15 Non-AVID school groups and 15 AVID groups. The Non-AVID PSAT mean score (*M* = 586.133, *SD* = 231.278) and AVID PSAT mean score (*M* = 585.400, *SD* = 233.636) are reported in Table 1.

Table 1

Descriptive Statistics of PSAT Mean Scores for School Groups

Measure	*N*	Mean	*SD*	*SEM*
Non-AVID PSAT score	15	586.133	231.278	59.715
AVID PSAT score	15	585.400	233.636	60.324

The data in Table 1show there are 15 Non-AVID and 15 AVID groups. Non-AVID

PSAT mean scores (*M* = 586.133, *SD* = 231.278) are somewhat similar to the AVID PSAT mean scores (*M* = 585.400, *SD* = 233.636), according to the results of the independent samples *t*-test for Research Question 1.

Results

Data Screening

Prior to the inferential analysis, the PSAT scores were screened for outliers. Data screening of variables involved plotting the PSAT scores for AVID and Non-AVID groups. The plots of the mean scores for AVID and Non-AVID program groups are shown in Figure 1.

Figure 1

AVID and Non-AVID Mean Score Plots

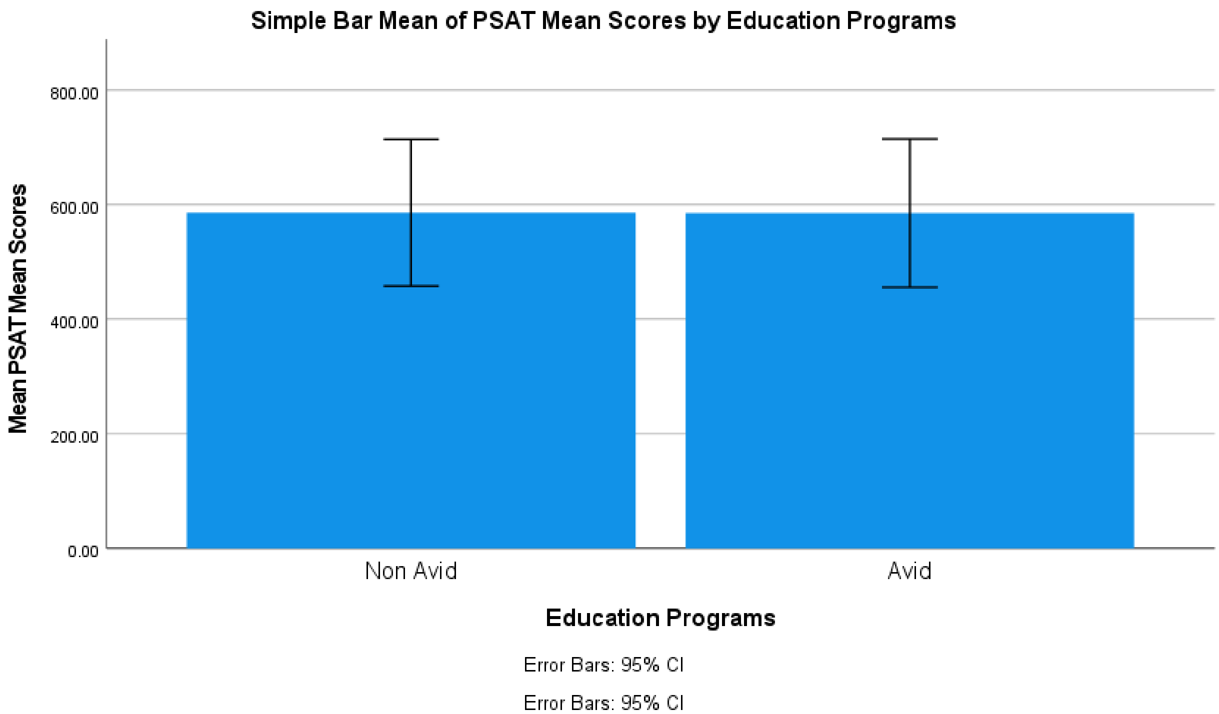

Figure 1 illustrates results of Box and Whisker plot of differences in the PSAT mean scores for groups in the two programs. An inspection of box plots for the data did not reveal outliers in the data for values greater than 1.5 box-lengths from the edge of the box. Also, there were no missing cases.

Assumptions

The application of tests in the analysis of data is based on meeting their assumptions. The independent samples *t*-test assumes one continuous dependent variable and one categorical independent variable (with 2 levels); the two samples are independent; the two samples follow normal distributions and can be done with normality check (Warner, 2013). Assumptions tested included normality and homogeneity of variances The Shapiro-Wilk test examined assumptions of normality (Table 2).

Table 2

Test of Normality

PSAT Score	Shapiro-Wilk		
	Statistic	*Df*	Sig.
AVID	.873	15	.038
Non-AVID	.892	15	.073*

**p* >.05.

The test of normality revealed that PSAT mean scores for the AVID group (W(15) = 0.87, $p = .038$) do not fit the normal distribution according to the Shapiro-Wilk test ($p < .05$). The PSAT mean scores for the Non-AVID group are normally distributed W(15) = 0.89, $p = .073$), as assessed by Shapiro-Wilk test ($p > .05$). The sample sizes in each group are equal and therefore do not present a strong violation of normality. Because the independent samples *t*-test is robust to deviations from normality (Wiedermann, 2017), the analysis continued with the decision to run the independent samples *t*-test. The Levene's test for equality of variances showed there was homogeneity of variances for PSAT mean scores for Non-AVID and AVID groups (*p* = .884). Table 3 illustrates the statistics for RQ 1.

Table 3

Independent Samples Test for RQ 1

	Levene's Test		*t* Test for Equality of Means					95% CI	
	F	Sig,	*T*	*Df*	Sig. (2-tailed)	Mean difference	Std error difference	Lower	Upper
PSAT equal mean scores assumed	.022	.884	.009	28	.993	.733	84.882	-173.140	174.607
Not assumed			.009	27.997	.993	.733	84.882	-173.141	174.608

Table 3 reveals there was homogeneity of variances for PSAT mean scores for Non-AVID and AVID groups according to the assessment of the Levene's test for equality of variances (*p* = .884). The PSAT mean score for Non-AVID groups (*M* = 586.133, *SD* = 231.278) and AVID groups (*M* = 585.400, *SD* = 233.636) were somewhat similar; the difference was not statistically significant, *M* = 0.733, (*SE* = 84.882), *t*(28) = 0.009, *p* = .993, *d* = .003. Therefore, the researcher failed to reject the hypothesis; there was no statistically significant difference in the mean scores on the Preliminary Scholastic Assessment Test for Advancement Via Individual Determination groups and Non-Advancement Via Individual Determination groups.

These results suggest that the AVID program does not have a statistically significant influence on PSAT mean scores.

Summary of Findings

Research question one examined 15 Non-AVID and 15 AVID participant groups scores.

An independent-samples *t* test was run to determine if there were differences in mean PSAT scores between Non-AVID and AVID groups. There were no outliers in the data as assessed by inspection of a box plot. The PSAT mean scores for the AVID group (W(15) = 0.87, *p* = .038) do not fit the normal distribution according to the Shapiro-Wilk test (*p* < .05). The PSAT mean scores for the Non-AVID group are normally distributed W(15) = 0.89, *p* = .073), as assessed by Shapiro-Wilk test (*p* > .05). There was homogeneity of variances, as assessed by Levene's test for equality of variances (*p* = .884). The PSAT mean score for Non-AVID groups (*M* = 586.133, *SD* = 231.278) and AVID groups (*M* = 585.400, *SD* = 233.636) were somewhat similar; the difference was not statistically significant, *M* = 0.733, (*SE* = 84.882), *t*(28) = 0.009, *p* = .993, *d* = .003. Therefore, the researcher failed to reject the hypothesis.

CHAPTER FIVE: CONCLUSIONS

Overview

This chapter includes a discussion the results of findings and their implications for practice. The discussions incorporate implications based on the literature reviewed and the theoretical framework of the study. Limitations of the study and recommendations for future research culminate the chapter.

Discussion

The purpose of this study was to analyze the difference between the performance of AVID and Non-AVID groups. The study examined PSAT mean performance scores of groups in 15 middle schools in Texas to determine whether scores differed between AVID and Non-AVID groups for school year 2016-2017. AVID is a college and career readiness program that features nine core strategies: collaborative structures, collaborative study groups, family engagement, focused note-taking, higher level thinking, organizing materials, philosophical chairs, relationship capacity and a Socratic seminar. There are four domains-instruction, systems, leadership, and culture within schools (AVID Center, 2020). Characteristic of the program is the infusion of various technologies in instruction. The study explored one basic question that this discussion expounds upon.

The research question inquired, "Is there a difference between the performance mean scores of groups in Advancement Via Individual Determination and performance mean scores of groups in Non-Advancement Via Individual Determination in middle schools as measured by the Preliminary Scholastic Assessment Test?" Hypothesis testing through an independent samples *t* test showed there was not a statistically significant difference in the performance score means of the PSAT between the two groups. The results were consistent with some other studies that have compared the performance of AVID participants with non participants. Huerta et al. (2013) and Montoya (2015) examined the influence of students participating in AVID programs at the middle school level. Although findings did not reveal differences in scores on the ACT and other standardized tests, other performance measures showed that AVID students exceeded the performance of Non-AVID students.

As noted earlier, statistically significant differences were not found between the two groups; the mean scores of the Non-AVID group were somewhat similar. However, given differences in other types of performance measures reported suggests participating in AVID was relevant to student performance beyond PSAT scores. A review of the demographics of these groups showed higher percentages for attendance, grade point average, and enrollment in higher level courses for the AVID group than the Non-AVID group. These and other positive trends have been consistent in other comparative studies of these two groups.

Findings show that students enrolled in middle and high school AVID programs are more likely than Non-AVID students and AVID students enrolled for less than two years, to take Accelerated Placement courses, develop a more positive attitude toward school and higher education, have higher grade point averages to be on track to graduate, and complete entrance requirements for college (Court & Janicki, 2016; Huerta et al., 2013; Montoya, 2015). These observations support that although the statistical analyses suggest that participation in AVID do not lead to higher PSAT scores than those of non participants, participation in AVID leads to more positive outcomes than non-participation in the program.

This study ascribed to theories that connected the construction of knowledge with motivation for learning and self-efficacy with motivation (Bandura, 1977; Vygotsky, 1978). In that respect the literature provides support for the role of technology in motivating student learning. This study focused on the infusion of technology in the AVID program and its role in motivating student learning. According to the AVID Center (2016), the use of technology facilitates the learning process through motivating learners and promoting problem solving. Although the views of the value of technology are somewhat mixed, agreement can be found that the appropriate use of technology enhances student learning (Bouygues, 2019; Kardefelt-Winther, 2017; McCann & Lawrence, 2015).

The learning process in AVID has been linked with the use of technology tools. An evaluation study of AVID programs in the Virginia Beach City Schools (Court & Janicki, 2016) showed that 92% of the students and 100% of teachers of elective courses employed collaboration to facilitate critical thinking. In facilitating the learning process through collaboration, 89% of the students employed multiple digital sources to access and evaluate information. Likewise, from 89% to 100% of AVID core and elective teachers, tutors, and parents also consulted multiple digital sources in the collaborative focus for student learning (Court & Janicki, 2016).These tools permit the active participation of students to construct knowledge through such activities as research and problem solving which involves reasoning about purposes, relationships, and resources needed to create or suggest solutions to a problem or situation (Greene et al., 2017). Agreement can be found in the literature to support such strategies to mitigate such factors as poor academic performance and school attendance. According to Ticuşan (2015), mitigation of these factors would include establishing collaborative student-teacher relationships, and improving family-school relationships. Strategies in AVID curricula include teacher's use of personalized instruction and encompass the collaborative features described prior. Unfortunately, limitations of the current study associated with the COVID-19 pandemic prevented an examination of curriculum and instructional practices that may have provided clarity in the role of technology in the AVID program of the schools in the dataset.

The theoretical framework for the study acknowledges that self-efficacy can be fostered through strategies included in the instructional process. The AVID program features strategies aimed at enhancing self-efficacy for a population of students at risk of poor performance in school from elementary through high school levels. Research has shown that elementary students enrolled in AVID developed increased self-efficacy which resulted in improved academic performance (Danskey, 2017). Similar to the performance scores of the current study, in a mixed- methods study of elementary AVID students, Danskey (2017) did not find statistically significant differences in academic self-efficacy per survey responses of AVID and Non-AVID groups. Differences did exist according to ethnicity and individuals with a special education designation. However, the qualitative results revealed that AVID students indicated that their academic self-efficacy had increased (Danskey, 2017). Another mixed-methods study of high school AVID students illustrated that AVID participation was associated with their academic success and ability to transition to college (Watt et al., 2011).

The academic performance of AVID students in the study often exceeded that of Non-AVID students. The archived data for both groups contained performance based on state tests, attendance, and other measures associated with school success. AVID students typically scored higher in the areas of science and social science than Non-AVID students. Non-AVID students typically scored higher in mathematics and writing performance than AVID students. In general, more than 16% of AVID students completed credit bearing courses with a C or better average than Non-AVID students. Consistent with Watt et al.'s (2011) findings, the performance of the study's sample has possible implications for their ability to transition to college as among influences of their participation in AVID.

Previous examinations of scores on some standardized and state tests among AVID and Non-AVID groups reported no statistically significant differences in performance. For example, the Research Educational Report (2017) for AVID 2015-2016 indicated AVID scores on the SAT exam were not significantly different from Non-AVID scores. Although the mean scores on five state tests were higher for AVID groups than Non-AVID groups, statistically significance difference was only found for one test, STAAR reading, where scores were 17.3 points higher for Non-AVID students in sixth grade (Research Educational Report, 2017). For the 2015-2016 school term, the comparison of AVID and Non-AVID groups at grades 8 and 11 revealed Non-AVID groups scored significantly higher on mathematics and PSAT scores for grades eight, ninth, and eleventh (Research Educational Report, 2017).

Mixed results of the AVID program have been reported in schools throughout the United States. A study of select Chicago high schools found that the program did not result in significant gains in the areas of "math, reading, and science" on state tests (Sparks, 2011). The study recognized the need for a school-wide support structure for implementing AVID. However, the results of student performance in an AVID national demonstration school in San Diego showed that "the school's Academic Performance Index was 805 (based on test scores and other data) in 2012, surpassing the state's goal of 800 for all schools"(Magee, 2015, para.16).

Additionally, the program has been evaluated based on its major mission of career and college readiness for students at-risk of poor performance. The National Student Clearinghouse provides information about AVID high school graduates who enter college. Magee (2015) reported results of the clearinghouse for the 2010-2011high school graduating class where "87 percent of AVID graduates enrolled in a second year of college, compared to 77 percent of students overall" (Magee, 2015, para. 3). According to the Dallas News Administrator (2014), 73% of AVID graduates entered college for fall 2010. Nationally, 58% represented low-income students, but 67% represented low-income AVID students. These statistics imply that features of the AVID program result in positive outcomes despite insignificant PSAT scores when compared with Non-AVID groups.

Early evaluations of AVID are based on objectives other than standardized performance scores. These evaluation studies featured such goals as increased enrollment in algebra and other courses as a result of the AVID program. Often the evaluations recognized inconsistencies in the administration of the program in schools. This observation was included in an evaluation of middle schools in North Carolina's Wake County Public Schools (Lougee & Baenen, 2008) where enrollment of students in Algebra 1 by eighth grade represented the performance indicator. Although the goal was not attained, success was evident in that more than a fourth of the six grade students in school year 2005 remained in AVID through the eighth grade in 2008 (Lougee & Baenen, 2008).

An early evaluation of Nevada's Clarke County Schools revealed dropout prevention and graduating students were the ultimate goals for instituting the ADVID program. Performance measures for these goals included enrollment of students in advancement placement and honors courses. Evaluation results showed that higher percentages of AVID students enrolled in these higher level courses than Non-AVID students. The report indicated that "the cumulative number of courses taken by AVID participants for both the 2004-2005 and 2005-2006 academic years was 119 compared to 61 courses for non-AVID participants" (Pitch et al., 2006, p. 5).

These early evaluations reflect goals and objectives of current AVID programs and have some similarities in program outcomes with the demographics of this study. For the 2016-2017 school term, of 8, 288 seniors in the state of the study, 31% had taken at least one higher level courses such as Advanced Placement or International Baccalaureate, and 94% had completed 4-year college entrance requirements (AVID, 2017). For that same term, 40% of AVID students had earned a grade of C or above in algebra or higher level math courses as compared to 29% of Non-AVID students. AVID middle school students exceeded the percentage of Non-AVID students on average of 15 or more points in passing the state's test in science, social science (with exception of seventh grade), reading, math, and writing (AVID, 2017).

The review of the literature reveals that findings of this study for the research question compare with other studies. The comparison between AVID and Non-AVID students is with respect to both higher and lower outcomes. Some reports show that the AVID program has not positively influenced student outcomes, and sometimes has had negative effects (Research Educational Report, 2017). However, many views of the program recognize the important role of the teacher in implementing the program components for the success of the program. The results have implications for student outcomes at the middle school and other levels of education.

Implications

This study compared the performance of AVID and Non-AVID groups on PSAT scores. Statistically significant difference in performance of the two groups was not found; mean scores of AVID and Non-AVID groups were similar in school comparisons. Consistency in this finding exists in other studies of schools. This consistency suggests the need for educators and leaders to invest efforts in determining what barriers exist in instructional programming that relate to this outcome. Interesting is that the performance on standardized tests such as the PSAT appears to be a deciding factor of the effectiveness of AVID; although AVID is traditionally focused on enhancing the education of low performing students, closing the achievement gap, preparing students for college readiness, and increasing graduation rates. Also, the literature reviewed did not illustrate that Non-AVID students performed any better on such tests.

Interesting as well was that the educational agencies included in the literature reported did not stress the use of technology in the intervention. Some evidence of incorporating technology in instruction existed through a collaboration component of instructional activities. Various technological tools were used in collaborative activities involving students and parents. However, as AVID contains strands where technology infusion could appropriately apply, its use may enhance students' test taking and study strategies that could result in changes in outcomes on standardized tests. Research has shown that students' performance in reading, writing, and mathematics improves when technology is effectively integrated into classroom instruction (Bouygues, 2019; Reboot Foundation. 2019); therefore, the likelihood that technology could assist in changing the status of test performance outcomes is reasonable.

Results of studies on student performance have implications for examining various factors that may influence performance. Motivation and technology infusion are among factors. This study was not designed to identify performance factors, but the nature of AVID suggests factors that may relate to the finding of no statistically significant difference in the two groups' PSAT scores. The review of AVID programs showed that groups were more likely composed of females, African Americans, economically disadvantaged, and military connected students. As previously indicated, AVID traditionally targets low performing students. Motivating students at risk of dropping out of school is among factors that influence performance. This study's framework and literature reviewed supported that various technologies enhance student motivation and performance (Bouygues, 2019; Byrne et al., 2016; Kardefelt-Winther, 2017).

This study's theoretical framework and supporting literature also suggest that multiple skills are important to performance on tests to include problem solving, critical and creative thinking, and visualizing. Technological tools have been instrumental in promoting these and other skills. For example, video games potentially allow students to apply and sharpen skills learned in school to include creative thinking, visual imagery, and problem solving (Byrne et al., 2016). Also, digital technologies integrated in the classroom have implications for motivating students. Studies reveal that integrating technological devices, such as clickers, tablets, and intelligent tutoring systems, promotes collaboration among students and improves social skills (Kardefelt-Winther, 2017; Reboot Foundation, 2019).

An important implication based on using technological tools to motivate AVID learners is the role of the teacher. Program evaluations of AVID imply the need for professional development to prepare teachers for effective implementation of AVID, for effectively integrating technology in instruction, and for administrators to find ways to enhance student learning (Bouygues, 2019; Danskey, 2017; Research Educational Evaluation Report, 2017).To address these multiple skills and ensure better student performance suggest the need for a school and community-wide collaborative effort.

Limitations

This study has limitations in the availability of data. Circumstances surrounding COVID-19 impacted the willingness and availability of personnel in schools and districts to engage in doctoral research activities. Therefore, the data analyzed for this study were based on average percentage scores of AVID and Non-AVID groups rather than the actual scores of individual students. Also, data were not available for making comparisons of scores within the groups based on such demographics as gender and grade levels within the middle school designation. The data limitation hindered the analysis that would have provided a more robust illustration of differences within and between groups.

The time period of the data was earlier than originally expected. Although the 2016-2017 dates of data were relevant to findings of recent and older studies, data for the 2018-2019 school year may have yielded other results. Also, without supporting materials in the form of district reports of instructional strategies and factors influencing student performance, implications of possible causes of the performance on the PSAT are limited. These limitations also suggest limitations in the generalizations of the findings beyond the sampled population.

Recommendations for Future Research

The following recommendations consider research aimed at school efforts in implementing the AVID program.

1. Schools should conduct self-studies of programmatic features of their AVID program to determine gaps that signal where more student support is warranted.
2. A longitudinal study of AVID participants from elementary to college may provide useful data for making program changes at all school levels that would best support students' needs at each level.
3. A qualitative study of AVID students designed to acquire their perspective on the most favorable, less favorable features of the program may lead to program redesign.
4. A study that explores different variables such as gender, ethnicity, socioeconomics, school climate, and technology infusion may yield implications related to students' academic and test performance.
5. Perception studies involving teachers and administrators could focus on the most effective and least effective features of the AVID program and their professional development needs for implementing the program school-wide are recommended.

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