A CASE STUDY ASSESSING PERFORMANCE DIFFERENCES BETWEEN ECONOMICALLY IMPACTED AFRICAN AMERICAN AND WHITE STUDENTS IN HIGH SCHOOL ALGEBRA II CLASSES IN THE TUCSON UNIFIED SCHOOL DISTRICT

Bennie W. Baker

Dissertation Prepared for the Degree of

Doctor of Philosophy

UNIVERSITY OF NORTH TEXAS

May 2020

APPROVED:

Dr. Tandra Tyler-Wood, Major Professor
and Chair of the Department of
Learning Technologies
Robert Wright, Committee Member
Jonathan Michael Spector, Committee
Member
Kinshuk, Dean of the College of Information
Victor Prybutok, Dean of the Toulouse
Graduate School

ACKNOWLEDGEMENTS

This research was inspired by the spirit of my ancestors. I am grateful to them for the countless sacrifices that were made to survive torturous labor while withstanding inhumane treatment, degradation, humiliation, and subjugation, and being stripped of their history, intellect, culture, and dignity for over 350 years while building this nation directly and indirectly.

I dedicate this effort to the memory of my mother, Helen Baker Donnell, my father, Bennie Baker Jr., and my brother Ricky; also, to my children: Desteney, Mikaila, Christian, and Simeeyah. My wife, Michaela Baker, for dealing with the many academic demands that imposed on our courtship and persisted to steal me and my attention away during our first two years of marriage. Finally to my adopted children: J Dominick, Damiean, Alex, and Patti.

I thank the UNT Department of Learning Technologies. Dr. Tandra Tyler-Wood, thank you for your confidence in me; Dr. Robert Wright for pushing and leading me; Dr. Jonathan Spector for challenging me and helping me manage the most difficult times in my life; and to Dr. Foshay my first Mentor who was always wise. Many thanks to Cohort 2019; we stuck together and continued to encourage each other throughout this entire journey.

Many thanks to Tucson Unified School District, especially Assistant Superintendent Ernest Rose, I greatly appreciate your direction and management of my needs in getting this study off the ground. Thanks to the Russell Doty, Mary Morse at and Judy Mitchell.

I would also like to thank my church, Rising Star Missionary Baptist of Tucson, AZ, and my Pastor, Amos L. Lewis, for the flexibility to miss meetings and some Sundays to get things done. Lastly, but certainly not least, I thank my Lord and Savior Jesus Christ for guiding me through topic selection and essential content that kept my fire burning through the darkest and most challenging times. It was Christ that kept me going when I was ready to quit time and time again. “He who endures to the end, the same shall be saved” (Mt 24:13).

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER 1

INTRODUCTION

Background

Various efforts have been made to assess the gap in testing scores between African Americans and their white peers (Du, Havard, Sansing, & Yu, 2004). Some authors argued that poverty juxtaposed with socio-environmental factors influences the ability of African American students who attend schools in low-income regions to excel in comparison to similar students who are afforded more opportunities and resources in affluent schools (Du et al., 2004). Similarly, Jacob and Lovett (2017) posited that the unequal distribution of resources has yet to be validated in regard to its impact on the Black White test score gap (BWTSG). Perhaps extensive studies exploring current resource allocation as it is related to the achievement of economically impacted African American students have yet to be attempted in academic literature. Furthermore, academic research regarding the testing score differences for economically impacted students enrolled in specific subjects is absent from current academic literature. Thus, Riegle-Crumb and King (2010) suggested that future research on disparities in achievement should focus on specific subjects to assess where future resources may be needed for students of color. The persistence of the BWTSG is a reminder that the efforts to improve academic performance among African American students have failed and fresh ideas are imperative (Jencks & Phillips, 2011).

In light of this gap, a case study was employed to examine Algebra II classes of two schools where both have technological resources for the purpose of teaching and student assessment: one is set in an affluent area of the city of Tucson and the other school in a low-income region. The impact of affluence and poverty on resource distribution and the results of

student performance on second semester Algebra II exams are the topic of this case study. The following section presents the purpose of the study and details the specific research questions used to address the identified research gap in the reviewed literature.

Statement of the Problem

Since the historical introduction of tracking testing and academic performance in public schools, African American students have rated well below their White peers in standardized test results (Barton & Coley, 2010; Jencks & Phillips, 2011). Jencks and Phillips (2011) noted that the gap is identifiable as early as kindergarten and can be traced into adulthood. This gap was first referred to as the BWTSG by Phillips, Crouse, and Ralph in 1998. Since the introduction of the term BWTSG, numerous researchers have investigated the reasoning for identified test score inequalities, to include (a) access to quality teachers, (b) teacher salaries, and (c) inequalities in resource distribution (Meier, 2004; Barton and Coley, 2010).

Multiple researchers have addressed this variance in test scores, but of the many strategies addressing this variance, there is no evidence that desegregation and proposed strategies of equal education and increased funding have produced sustained reductions in the test score gap (Barton & Coley, 2010; Meier, 2004). Jencks and Phillips (2011) acknowledged that there has been a slight decrease in the BWTSG since 1970, yet African Americans as a group tested below 75% of Whites, which is a considerable disparity (Farkas, 2004). Farkas (2004) noted a 40% decrease in the BWTSG between 1970 and 1990, but after 1990, African American students' achievement reversed, and the gap widened. Similarly, Mitchell (2018) in an Illinois study, found that African American students continue to underperform on state and district tests. Mitchell posited that the gap separating African American and White students in math was at 41% at the time of her 2018 study and stated that Black students have historically

scored and achieved lower than their White counterparts. The studies of Farkas (2004), Mitchell (2018), and Barton and Coley (2010) indicate that proposed methodologies for decreasing the BWTSG have failed.

Technology has been suggested as a tool that might be used to reduce the BWTSG. In fact, some learning opportunities provided through technology have been explored in depth, such as multimedia and educational technology usage among African American students (Darling-Hammond, Zielezinski, & Goldman, 2014). However, Du et al. (2004) indicate that variables such as self-efficacy and poverty, in juxtaposition with social and environmental influence, limit the availability and opportunity to adequately use educational technology among African American and low-income students.

Purpose of the Study

As previous studies have indicated that socioeconomic factors may impact the BWTSG (Reardon, 2013), the purpose of this case study was to assess if there were differences in test scores in mathematics classes between African American and White students of both similar and differing socioeconomic status (SES) when comparing two Tucson (Arizona) area high schools in the Tucson Unified School District (TUSD). This case study assessed the performance of math students, specifically Algebra students. Comparisons were made between the groups: affluent African American students were compared with African American students of low-income status and affluent White students were compared to White students of low-income status. Comparisons were then made among affluent African American students to Affluent White students and African American students of low socioeconomic status to their White peers. Though causes of any variance that was found were not sought, the variance in the SES of each school's general population was considered as a possible contributing influence in student

performance. This data was also used to explore the impact of classroom technology used by the district between academic years 2016 and 2018. Data collected in this case study could be valuable to others in a more in-depth study for multiple purposes, such as determining the effectiveness of specific technological devices in teaching or determining cost benefit ratio for future purchases. Ideally, the results of this case study should indicate whether scores differ between these affluent and lower socioeconomic schools for students in Algebra II classes.

Exploring differences between affluent and lower socioeconomic schools are investigated through the following factors: (a) poverty (Card & Rothstein, 2006) and (b) the learning environment (Schulze & van Heeren, 2015). These factors are important as they could be claimed to parallel challenges that were faced by the population of the African ancestors of many in the African American student population involved in this case study. Furthermore, these factors may be common among students of any race suffering the impacts of living and learning in poverty. Expressly, slave society was one that was resistant to educating the African slave (Monaghan, 2007). Monaghan (2007) speaks of slaveholders attempting to kill all efforts toward literacy in fear of a rebellion. While it is without argument that transgenerational trauma is a phenomenon that needs further exploration, Yehuda, Daskalakis, Desarnaud, Makotkine, Lehrner, Koch, & Bierer (2013) (who are known for their work addressing trauma, Post-Traumatic Stress Disorder and epigenetics) believe that the trauma of chattel slavery has been genetically transmitted to descendants of slaves. Based on research conducted by Yehuda et al. (2013), it is possible that the transfer of educational trauma along with environmental factors could trigger a psychological response to the stress that is associated with the pressures of performance on academic exams and may result in inequities between African American and White students. Although this theory was not investigated in this case study, it should not be

overlooked in future research looking into factors contributing to the academic performance of African Americans.

Objective

The goal of this case study was to determine if there was a gap in the performance of affluent and low socioeconomic African American and White students on Algebra II tests. These tests were also explored between affluent and low-economic schools of TUSD. The following hypotheses were addressed during the analysis of this case study.

Hypotheses

To better understand the topic of inquiry, the following hypotheses were examined.

- African American students at an affluent high school did not have lower scores on second semester Algebra II exams than their White peers.
- African American and White high school students who are economically impacted by affluence perform on the same academic level in Algebra II.
- African American and White students who are economically impacted by poverty perform on the same academic level in Algebra II.

Research Questions

The following three research questions (RQs) were used to guide the exploration of this study.

RQ 1. What are the differences in the Algebra II test scores of students who attend an affluent school versus the Algebra II test scores of students who attend a low socioeconomic status (SES) school?

RQ 2. What are the differences in the Algebra II test scores of African American students and White students?

RQ 3. Is there an interaction between race and school that impacts test scores?

RQ 4. What are the potential technological factors that influence disparities in the performance of students identified in this study?

Assumptions

The following assumptions underlay this research.

- African American student sample sizes will be small due to only a 5% African American population across the city, as well as the state.
- Student populations discussed in this case study were primarily from the geographic neighborhoods in the general vicinity of the school's subject to this study.
- Students attending schools subject to this study were relatively impacted by the environments in which the schools were set.
- The technology that was available in the classroom for one student was available for all students in said classroom.

Rationale

Since the BWTSG is a national phenomenon (Craig & Scott, 2019; Rippeyoung, 2009), seeking data to study the performance of African American students locally was considered by this researcher to be a benefit to African American students. The review of literature revealed that there is a gap in research regarding a performance variance among African American and White students who have economic impacts of poverty and affluence (Ready, 2010; Thum & Hauser, 2015). Math performance involving students in high schools located in affluent areas versus students in schools in low-income areas may be of interest to the general body of knowledge in these areas. Therefore, high school Algebra II students were the subjects of this case study. The possible difference in the distribution of technology was also worth considering

due to the difference in the SESs of the two schools. The results of this study could be used to by those developing strategies to reduce the variance found in the BWTSG by focusing on the influence of the socioeconomic variance of the students and the schools that they attend.

Significance

There is an underrepresentation of African American students entering science, technology, engineering, and mathematics (STEM) majors in colleges (Estrada, et al., 2016). This, according to (Estrada, et al., 2016), has affected the STEM job market. The contributions of this research study may interest African American educators specifically, as well as college administrators. Additionally, data from this research may be of significance to African American parents, African American students at large, and researchers who wish to assess how poverty leads to the BWTSG or how through affluence it can be avoided.

Ideally, this case study has the ability to lead educational institutions who are directly involved in the education of African American students to explore why groups of students with lowered SESs perform at reduced rates when compared to their affluent peers (Reardon, Kalogrides, & Shores, 2019). Moreover, if differences exist between poor and affluent schools, then administrations, educators, researchers, and political advocacy groups may be better able to identify how schools in specific socioeconomic regions may be improved for the efficacy of educating African American students equitably with their White counterparts. Finally, it was hoped that the information presented in this study can be provided directly to those who could benefit from it—the student participants themselves.

This case study is significant because there have been numerous attempts to examine the BWTSG (Barton & Coley, 2010; Hutchinson & Mitchell, 2019; Jencks & Phillips, 2011; Lewis & Hunt, 2019; Reardon et al., 2019; Rodriguez & McGuire, 2019; Vigdor & Ludwig, 2007) to

find an answer to the question of the variance between African American and White students, yet no answer has been found. Many studies have been conducted and research undertaken, all to reduce and explain the persistence of this phenomenon, yet none have been successful (Jencks & Phillips, 2011; Meier, 2004; von Hippel & Hamrock, 2019). It was a desire that this research reveal reasons for the gaps in math scores of Black and White students from both affluent and low-income SESs, which could be used in future research involving the BWTSG.

The issue of the BWTSG has been of interest from the student's house, to the schoolhouse, all the way to the White House, and many places of import in between (Craig & Scott, 2019). The impact on the African American demographic has been measured economically concerning barriers to employment, as well as academically, where there may be a race-based denial of quality education (Jencks & Phillips, 1998; Meier, 2004; Mitchell, 2018).

It was hoped that this case study will help institutions and administrators involved in the education of African American students in the TUSD to understand how the phenomenon known as the BWTSG has affected their students. Namely, whether SES has impacted the performance of students at schools in affluent and low-income regions. This is important since most research investigating the BWTSG reveals that African Americans perform at rates below their White peers (Reardon et al., 2019). Additionally, this case study could contribute to lifting the self-efficacy of African American students and provide motivation to succeed. The current study may provide information instructors can use as they design courses that could be a key in addressing solutions for underperformance by their economically impacted White and African American students.

Definition of Terms

The following terms were used in the literature review or in analysis and are provided for clarification and context of the author's intention.

Academic Year. The time period that begins with the first official day of school for the student and ends with the last official day of the respective school year.

Chattel Slavery. Google dictionary defines slavery as the practice or system of owning slaves. DeGruy (2005) defines chattel as a moveable item of personal property. It is important to clarify for the purposes of this case study that the American institution of slavery involved people owning other people as objects instead of humans. This will help the readers to understand that choices were made institutionally on a national level to restrict generations of people from tools needed to complete their cognitive development. Thus, chattel slavery is that form of slavery whereby persons were purchased and sold as personal property and thereby had no human rights, and by the laws of that institution were forbidden the right to education under the threat of punishment or death.

Chronic Absenteeism. The unduplicated number of students absent 10% or more school days during the school year (U.S. Department of Education, 2017).

Economically Impacted. The influence of efficacy, motivation, desire, sense of wellbeing, sense of worth, feeling of belonging, or preparedness that is associated with one's SES.

Epigenetics. The study of heritable changes in gene expression that are not due to changes in the underlying DNA sequence. Such heritable changes in gene expression often occur as a result of environmental stress or major emotional trauma and would then leave certain marks on the chemical coating, or methylation, of the chromosomes.

*Low Income***.** The financial situation of an individual whose family's taxable income for the preceding year did not exceed 150% of the poverty level amount (Figure 1; U.S. Department of Education, 2010).

(Effective **January 11, 2019** until further notice)

Size of Family Unit	48 Contiguous States, D.C., and Outlying Jurisdictions	Alaska	Hawaii
1	$18,735	$23,400	$21,570
2	$25,365	$31,695	$29,190
3	$31,995	$39,990	$36,810
4	$38,625	$48,285	$44,430
5	$45,255	$56,580	$52,050
6	$51,885	$64,875	$59,670
7	$58,515	$73,170	$67,290
8	$65,145	$81,465	$74,910

Figure 1. Federal TRIO program 2019 low-income levels. TRIO is a group of three educational opportunity programs administered by the U.S. Department of Education. Retrieved from https://www2.ed.gov/about/offices/list/ope/trio/index.html

Low SES. Socioeconomic status (SES) is usually measured by determining education, income, occupation, or a composite of these dimensions (Winkleby, Jatulis, Frank, & Fortmann, 1992).

Post Traumatic Slave Syndrome. Post Traumatic Slave Syndrome is a pattern of behaviors that are brought about by specific circumstances. The circumstances that produce Post

Traumatic Slave Syndrome are multigenerational trauma and continued oppression, plus a real or imagined lack of access (DeGruy, 2005).

Transgenerational. The transmission of characteristics from parents to their offspring (Phipps & Thorne, 2019).

Limitations

One limitation of this study was the length of time it took to collect an adequate amount of data. The cost affiliated with such collection was also a challenge. Scheduling time with administrators at the school district to discuss this research project was difficult. There was resistance to cooperate with the study by some teachers who were key to data collection, which may have been based on a misunderstanding of its purpose. Getting past my personal experience-based bias of the reviewed literature and remaining objective was also a challenge.

Broad Contextual Framing

Another complication was the controversial nature of the research focus. In 2015 when this research study began thru 2016 when data collection was initiated, the United States was experiencing heightened racial sensitivities. This was due, in part, to incidents revolving around the debates and campaign atmosphere of then Presidential Candidate Donald Trump. Furthermore, the assumptions and objectives of the research could have resulted in an unwillingness to assist in the collection of data. This same spirit could taint the reputation of the research itself and draw unwarranted negative scrutiny.

Local Contextual Framing

Tucson is appropriate for this study because Arizona ranked as the 4th most impoverished state in the nation and Tucson was one of the state's most impoverished cities, with one of the highest percentages of undereducated populations (U. S. Census Bureau, 2018). Thus, the

student population here was appropriate to investigate the variance between White and Black students from a perspective of affluence and poverty. A final and more probable complication was insufficient numbers of African American high school students in the TUSD to obtain an adequate sample; only 5% of the Tucson population was African American at the time of the study.

Summary

This chapter began with an introduction, which gave a brief overview of the study. This was followed by a background section that mentioned some major themes to be consistent throughout, such as (a) the BWTSG and (b) technology. Then, the purpose of the research was given, as well as the objectives and hypotheses followed by the RQs. Assumptions were then stated and the rationale for the inquiries was given. The significance of the study, the definitions of terms, and limitations were given to promote this research, and broad and local contextual framing was given as well. Finally, personal bias was revealed to close out this chapter. The following chapter will explore the literature that was investigated as a part of the study.

CHAPTER 2

RELATED LITERATURE

Introduction

The U.S. education industry generally associates a student's academic growth with his or her performance on standardized tests, as well as formative, interim, and summative assessments (Reardon, 2013). Written student assessments came into existence due to a transition from catering to the elite by offering them oral exams; this was changed between 1840 and 1875 to pursue the goal of providing fairness in educational opportunities for all students instead of using comparison-based options that generally favored those of status (Protheroe, 2001).

Anderson (2004) believed academic progress has persisted throughout the decades but claims that the historical record used to justify the BWTSG, which depicts an ongoing variance between the academic performance of African American and White students, is not accurately represented and is misunderstood. However, Meier (2004) asserted this progress is not steady and adds that quality education for some students only is not appropriate. Nevertheless, while Craig and Scott confirmed that a BWTSG exists in every state; they also claimed that math scores for Black students in the state of Arizona join Texas, Massachusetts, Virginia, Colorado, and New Jersey as being above the national average. Conversely, Arizona ranked in the bottom 10% of all states for its education system.

In search of an answer to the persistent variation between African American students and their White peers, scholars have studied multiple factors as possible influences on academic performance. Thum and Hauser (2015) postulated that poverty among students who start elementary school may contribute to a decreased vocabulary, which impacts a student's ability to learn and contributes to high drop-out rates. Quinn (2015) added to the argument that, among

kindergartners, a gap in reading skills could be explained by the student's SES and widening of the gap due to poor school quality; although variance in math could be explained by SES he did not believe that the widening of the math gap could be understood by SES, school quality, or a theory. Phillips et al. (1998) explained test score gaps that are present when children enter school are certainly a result of influences outside of the school; however, they continued stating that later gaps or persisting gaps result from a combination of factors present in and out of school. This researcher examined the performance of high school students with the assumption that Thum and Houser were correct in their consideration that poverty impacted academic performance.

The No Child Left Behind Act (2002) included efforts to address the performance variance between Black and White students evident in the BWTSG (Jencks & Phillips, 2011; Meier, 2004). Kim and Sudderman (2005) used data sets that included Arizona and stated that this act placed a high emphasis on poverty, associated it with race, and claimed that there was a high correlation between race and poverty. They further observed that there was a high enrollment of African Americans in high poverty schools. Although this act was highly informative, its efforts fell short in bringing about a sustained decrease in the variance of test scores between African American and White students. The Every Student Succeeds Act (2015) followed and added more targeted attempts to address the variance that was based on updated research (Darling-Hammond, Bae, Cook-Harvey, Lam, Mercer, Podolsky, & Stosich, 2016). Scholars and researchers continue to find some progress in improved academic performance. For example, Liou and Rotheram-Fuller (2019) concluded that African Americans have shown academic success in the use of technology. These observations did not include the contribution of SES to the stated results.

This researcher engaged in a case study of African American and White student performance in math, which included the factors of affluence and low-income status in the evaluation of student performance. The results may be a data source bringing light to the issue of BWTSG within mathematics classes in affluent and low-income schools.

Methodology of the Review

The objective of the literature reviewed was to determine if this case study has been completed before and to identify previous research on the BWTSG phenomenon. Thus, a decision to evaluate scholarly activity surrounding the performance of African American and White students in affluent and low-income regions was executed. A historical look into the subject, therefore, was necessary since the literature that was reviewed failed to reveal a trend of reduction in the achievement gap shown by the improved performance of African American students (Campbell, Hombo, & Mazzeo, 2000). In search of an understanding of the what, when, why, and how of the variance in student performance and the impact of a school's SES, there was a strategic selection of literature. The literature selected focused on factors that scholars from various platforms claimed to have contributed to the BWTSG: (a) SES of schools and its impact, (b) SES of students and its impact and (c) influence of technology on student performance.

Jencks and Phillips (2011) would warn that improved results could be temporary. Their results demonstrate that any resolution that seems to result as it relates to the BWTSG should be observed for a sustained level of academic performance. Readers are reminded that the progress of the 1970s noted by Jencks and Phillips (2011) did not eliminate the BWTSG; they added that 75% of African American students continue to score lower than the average White student. Thus, the gap remains. This is a general assessment of testing variance between these two races.

Addressing sustained performance, digital technology was considered by many scholars as a factor in providing an upward trend in performance through the use of learning technology (Davies & West, 2014; Maguire, 2005). The data revealed online learning technology was stable, in demand, and produced a constant improvement (Allen & Seaman, 2011). This study evaluates the influence of affluence and poverty on student academic performance.

Figure 2 depicts four circles interconnected with a fifth. Note that all circles share a commonality with the center circle and with each other. This presentation of the relationships between the central issues demonstrates that each factor has an impact on the central issue—the BWTSG. Although these factors primarily impact students individually, they can and do sometimes overlap; however, they each have a distinct impact without relying on the other.

Race

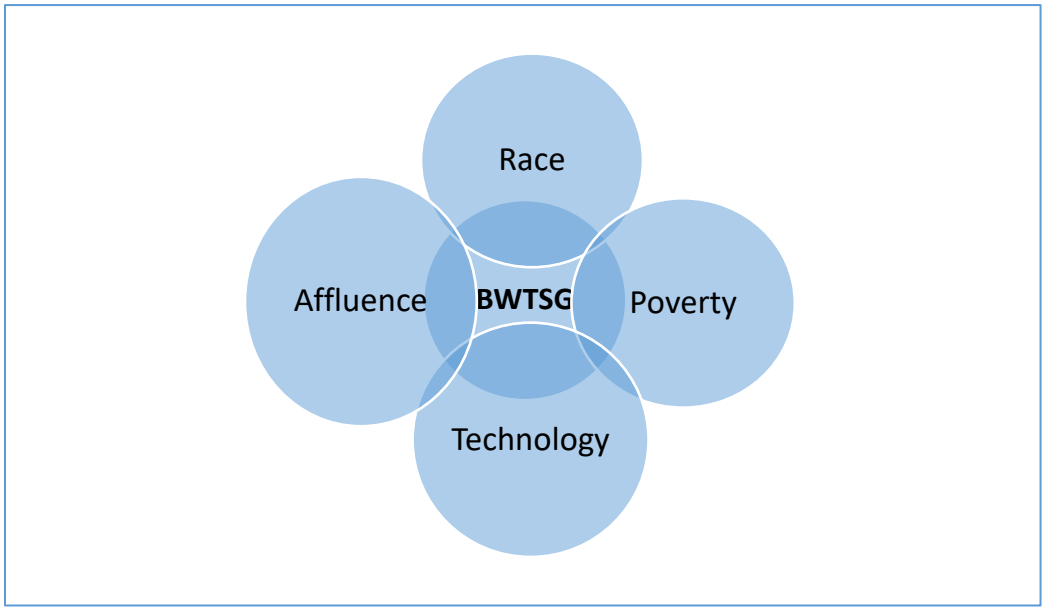

Figure 2. Factors impacting Tucson Unified School District student academic performance.

While there are many factors involved in the assessment of learning and many conjectures legitimately identifying symptoms that obstruct the learning process, Kim and

Sunderman (2005) found no evidence that strategic educational programs examined across six states resulted in improvements that were equal across racial subgroups. Furthermore, Owens (2016), in considering equality in educational opportunity across racial lines, found that although performance in affluent school districts did not reflect an achievement gap between races, African American high-income families did not always have access to affluent schools.

Race

Previous research provides theoretical attempts to clarify and/or explain why there is variance along racial lines in the U.S. education system (Barton & Coley, 2010). Most of the literature that was reviewed agreed that there is variance in the performance results of Black and White students in the United States (Wolf, 2005). Many causes have been alleged, investigated, studied, and researched. Nevertheless, SES seems to be a recurring and common factor when discussing the achievement gap and African Americans. In fact, Alexander, Entwisle, and Olson (2007) made a connection; first, when they claimed that wealthy families tend to live in affluent neighborhoods and send their children to better schools. They further alleged the opposite for low-income families and tied SES and race as base-lines for academic achievement. In addition, they stated that low-income families wanted the same opportunities for their children as affluent but lacked the means.

Resilience

The National Center for Education Statistics (2007) claims that African Americans are more likely to attend impoverished schools than would their White counterparts. In addition, Center and Council (2005) report African Americans as having (a) the highest numbers of children living in poverty, (b) the children with the most health problems, and (c) more children living in single parent homes than any other race. Along those lines, Banks (2010) argued that

children who live in poverty are less likely to attend schools with adequate resources and rigor or have opportunities to participate in extracurricular activities. Adding to the discussion, Rothstein and Wozny (2011) promoting the power of permanent income, found that a change in SES for African American families could close the BWTSG. As explained by Rothstein and Wozny (2013), a change in permanent income could bring about academic success even in the face of factors that arise from poverty. Duncan, Kalil, and Ziol-Guest (2013) seem to be in disagreement, as they specified that it is the timing of wealth that brings about academic success in later years in life. Their argument was that the ability to provide a child with a learning environment, infused with tools and toys of learning, during their developmental years allows them to master skills needed later in life that would be necessary to excel academically. Huettl (2016) agreed with all of those theories and posited that there was a correlation of poverty with race, academic struggles, and lists a variety of contributing factors.

Technology

Is technology the answer to African American student performance? It has been argued by many that the test score gap has not been affected by the introduction of technology. However, there was data available from previous research that promoted valid evidence of improved performance subsequent to the introduction of learning technology in classrooms (Hopson, Simms, & Knezek, 2001). Jencks and Phillips (2011) concluded that a change in the environment could greatly impact performance on academic assessments; they implied that the correct change in environment had proven to reduce the test score gap. Other research claimed that performance had improved subsequent to the introduction of learning technology and alluded to the possibility that it was technology that was responsible for the improvement (Hopson et al., 2001). Hopson et al. (2001) further claimed to have identified technology that, as

the substance for reorganization and restyling the classroom, should have generated an atmosphere that endorsed and inspired the growth of the advanced evaluation of skills. Both Maddrell (2014) and Hodgkinson (1985) looked at various aspects of technical instructional design as a way of addressing academic performance challenges.

Kennedy et al. (2007) claimed that the emergence of technology made possible a variety of educational events capable of increasing the process of student learning, as well as academic results and testing practices. Owens (2016) explained affluent families use their income to invest in their children's educational enrichment in the way of educational tools that include technology. Although there was some improvement noted, Davies and West (2014) stated that fourth-grade students who used technology to play learning games and develop higher order thinking performed only three-to-five weeks ahead of students who did not use technology.

Research also exists that showed no improvement in achievement in students who used technology in school. Hannum (2007) stated that there was no significant improvement in the academic performance of students in any grade nationwide in light of computer use. However, Fuchs and Woessmann (2005) found that bivariate evidence resulting from studies that evaluated the relationship of the educational achievement between students and computers was deceptive. Furthermore, they also found a natural bias, generationally and economically, that surrounded home computer use due to varied family habits. Accordingly, Fuchs and Woessmann (2005) stated that home use was determined by the characteristics of each family and this severely influenced the results, in that some homes had more technology than others did, while some had minimal connectivity; thus, these undercurrents influenced school use. Li, Atkins, and Stanton (2006) disagreed, claiming computer use at home resulted in enhanced computer use at school, which resulted in better performance on a standardized test than children who did not use

computers at home. Davies and West (2014) stated that the main use of technology by students was to structure, gather, examine, and deliver data; however, there had not been confirmation of vast improvement in the performance of students on tests as a result.

With the trending of technology more and more toward education, efforts had been made to introduce and target the use of technology to increase the academic performance of African American and low-income students.

Socioeconomic Status

Ormseth, Bell, and Camp (1990) conducted a study that examined the distribution of opportunities to learn math and science in primary and secondary schools; they found that the opportunities available for White students start out minimally different from those available to African Americans, Hispanics, and children of low-income families but become shockingly different as they progress in school. Reardon (2015) suggested that low-income schools are not effective in educating African American and Hispanic children and that the removal from poor peers could have positive impacts on the achievement gap. Burdick-Will et al. (2011) imply that better areas get better and more stable faculty. In fact, the belief was that the geographic location influences the given school's demography, which, in turn affects its financial stability and the consequential composition of faculty.

The U.S. Department of Education (2018) reported that STEM courses are not available to all students, noting that nationally (a) Algebra I was not offered in 14% of high schools, (b) 16% did not offer Geometry, and (c) 20% did not have Algebra II. The report further documents that math and science courses were offered at lower levels in more than 5,000 U.S. high schools with an excess of 75% African American and Latino student population.

Darling-Hammond (1998) reminded us that after 20 years of narrowing test scores (1970-1990), educational experiences for minority students remained unequal with 66% attending in urban areas that were not funded equally with suburban school districts. Burdick-Will et al. (2011) believed that students who lived in low-income regions had lower cognitive test scores as a result. Sablich (2016) added that the Black-White school readiness gap had not made a movement that could have been deviated from zero statistically. The comparison of student scores at opposing socioeconomic demographics may reveal a similar implication, which could be further explored in future research.

Milner (2012) argued that student learning opportunities were reflected in the outcomes of their tests. Milner (2012) further asserted that opportunity gaps existed that impacted student performance because teachers failed or refused to acknowledge the demographic divide between them and their students. Milner (2012) also detailed the impact of a gap in opportunities for students of color. McClure (2008) observed that the inequity of distributing funds from the state, federal and even local governments between high and low-income schools persisted.

Technology

Within the sphere of examining SES as an impact upon African American students, it was important to consider technological access. Should technology be considered when seeking the answer to removing the variance between African American and White students? A point of interest in this case study was the sensitivity to any obvious factors for the BWTSG, such as an unequal distribution of resources, as the review of the availability of technology was considered. One such situation is the use of technology as a contributing factor to better scores at one school may not be available to all students at schools on an equal basis, as discussed by Fuchs and Woessmann (2005).

It has been argued by many that the test score gap has not been affected by the introduction of technology. However, there was data available from previous research promoting valid evidence of improved performance subsequent to the introduction of learning technology in classrooms (Hopson et al., 2001). Jencks and Phillips (2011) concluded that a change in the environment could greatly impact performance on academic assessments; they implied that the correct change in the environment had proven to reduce the test score gap. Other research claimed that performance had improved subsequent to the introduction of learning technology and alluded to the possibility that it was the technology that was responsible for the improvement (Hopson et al., 2001). Gonzales et al. (2004) found that both students who were on free or reduced lunch and African American had lower scores than their peers. Exploring the academic performance of affluent versus low-income students would add more depth to the discussion regarding the BWTSG.

Hopson et al. claimed to have identified that, as the substance for reorganization and restyling the classroom, technology should generate an atmosphere that endorses and inspires the growth of the advanced development of skills. Kennedy et al. (2007) supported the idea that classroom technology would impact cognitive development and academic performance. Although there was some academic improvement noted, Davies and West (2014) state that fourth-grade students who used technology to play learning games and develop higher-order thinking performed only three to five weeks ahead of students who did not use technology.

Some research indicated the lack of improvement in academic achievement may have been a result of the uneven distribution of technology. Historically, the unequal distribution of these resources had resulted in inequitable learning opportunities and outcomes for different groups of students (Smith, Trygstad, & Banilower, 2016). Smith, Nelson, Trygstad, and

Banilower (2013) indicated that students from all walks of life were not equally resourced with teachers that were (a) well-prepared, (b) supplied with materials for instruction or course offerings in science, and (c) had instructional strategies in pedagogy. McClure (2008) revealed that it is possible that teacher pay was better in schools located in more affluent parts of town. McClure (2008) further recognized that it was also possible that teachers may have been more qualified and experienced due to the stability relative to better pay. Additionally, they showed that teachers in schools located in low-income neighborhoods left frequently to obtain better-paying positions where they were better trained and provided better tools.

Low SES

Darling-Hammond et al. (2016) argued that states and districts seeking to provide an equitable learning environment for all students of low SES should ensure funding supports their efforts, to include (a) the design of curriculum, (b) access to the needed materials, (c) training for their instructors, and (d) excellence in teaching. Reardon (2013) agreed but encouraged schools to allocate more funds and resources to elementary and preschool. Reardon (2013) further contended that states and school districts should ensure all students have equal access to academic resources including first-rate teachers.

High SES

Kornich and Furstenberg (2013), along with (Reardon, 2013), claimed that affluent families outspend low-income families by about seven times on education. Langevin (2015) was not indifferent but looked at the affluence of the school, instead of the families, and explained even though impoverished schools were accredited, they still trailed affluent schools.

Monroe-Lax and Ko (2017) found that there was a correlation between household economic achievement and student academic performance, as well as a connection in the school's

per-student spending and the performance of the students. Monroe-Lax and Ko (2017) conducted their study in the state of Mississippi, where the poverty rate was the highest in the country at 24% and 34% of the state's children lived in poverty. Arizona Population (2020) rated Arizona as having the eighth highest poverty rate in the nation at 16.56%. The Tucson poverty rate for 2019, however, was 24.1% (U.S. Census Bureau, 2018).

Motivation to Teach

The following section will discuss motivation in terms of possible reasoning discussed in academic literature for the purpose of assessing BWTSG. During the review of the literature, the question of whether or not students were motivated to learn and whether teachers were motivated to teach came to mind. Therefore, literature searches were initiated using the keywords *student motivation* and *teacher motivation.* The goal was to determine if student performance had been reduced due to a lack of motivation and to determine what variants could impact that motivation; the same was sought about teachers. The assumption was that unmotivated teachers would have unmotivated students and the test scores of all students would thus be affected negatively. To gain insight from a wider perspective, literature that revealed administrator's opinions was also reviewed.

In analyzing the sources of motivation, the factors needed for learning could be determined, as well as those that are, or are not, available. There was discussion in the literature of the elements involved in motivation for learning from three perspectives: (a) intrinsic, (b) extrinsic, and (c) administrative. Intrinsic motivation appeared to be the determining factor for those faculty members who were driven to participate in the learning process (Betts, 1998; Dillon & Walsh, 1992; Lee, 2001; Rockwell, Schauer, Fritz, & Marx, 1999).

Another motivator that is often overlooked is peer pressure, especially in the form of competitors (Olcott & Wright, 1995). According to faculty, the successful scholastic achievements among other faculty and programs within higher education institutions and other markets is a source of pressure (Betts, 1998). As many motivators as were discussed, there were equally as many inhibitors. Blackburn and Lawrence (1995) also focused on the motivation of faculty and determined that their motivation was a result of participation in instructional activities driven by attitudes, personality, value systems, and age, as well as their race and gender. These are contributing factors in the motivation of teachers and also affects where they employ, as well as their tenure at a given institution (Blackburn & Lawrence, 1995; Miller et al., 2008; Timothy, 2009).

Internal Motivators

The research reviewed resulted in the knowledge that the motivators that you cannot see, intrinsic, are more powerful than those that are seen, extrinsic. Maguire (2005), for example, explained that when it comes to the efficacy involved in the motivation to use technology, intrinsic motivation is responsible. Other studies support this finding (Bonk, 2002; Lee, 2001; Rockwell et al., 1999; Schifter, 2000).

External Motivators

Teachers claimed an increase in the quality of their courses when using technology as a medium to administer education. (Betts, 1998; Bonk, 2002; Rockwell et al., 1999; Schifter, 2000). In agreement, Maguire (2005) claims that a by-product of these recognitions and rewards

is greater appreciation and pride in a student's places of learning and a teacher's place of employment that serve as external motivators to both teacher and student alike.

Administrators on Teaching Technology

In a study that evaluated the perspectives of high school principals on the use of technology, Perkins-Jacobs (2015) found that principals saw themselves as technology leaders and felt inadequately equipped for this role. The author believed that administrators should be trained with a capability to support and provide guidance to their teachers who were charged with the responsibility to implement learning technology. Chang and Hsu (2009) found that an administrator's leadership in the integration of technology improved their teacher's literacy in technology and encouraged them to integrate it into their classes. Although they seemed to have had positive results in teacher/administrator interaction with technology, Machado and Machado and Chung (2015) found that most principals value technology but fail in providing adequate training to their teachers.

Summary

This literature review began with a general search seeking to understand why African Americans perform below their White peers and to determine if a student's SES was a relative factor. The literature spoke to many variables that had negative influences on the academic performance of African Americans. The journey lead from poverty, affluence, and motivation. The literature also spoke to the influence of SES on student performance (Monroe-Lax & Ko, 2017). Chapter 3 discusses the methodology for the current research.

CHAPTER 3

METHODOLOGY

Introduction

The previous chapter provided insight into the literature reviewed for this case study. The literature addressed the impact of affluence and poverty on the performance of both African American and White students. The phenomenon addressed was the issue of the BWTSG. This chapter discusses the methodology that was chosen to further study issues of race and income on academic performance, especially as it related to high school Algebra students in TUSD. Also discussed in this chapter is the data and how it was analyzed. This chapter describes the heart of this case study, to include the (a) ontology, (b) overview, (c) research questions, (d) ethical considerations, (e) trustworthiness, (f) potential research bias, (g) research design, (h) data collection, and (i) data analysis.

Ontology of the Study

The ontology of this research was based on a co-variant relativist perspective, wherein the phenomenon of the BWTSG was believed to have been dependent on the underlying independent variables of race and SES. The data was collected and analyzed with an epistemological approach. Steup (2018) explains that epistemology is knowledge as justified belief. Thus, the process of data collection considered the knowledge gained to be justified by the validity of the results of the analysis.

Overview of the Study

The current comparative case study considered the BWTSG variance of the Algebra test scores between a general group of African American students and a general group of White students (Jencks & Phillips, 2011) and the effect of technology on teachers and students in

TUSD. To clarify, the case under investigation was the study of the differences in test scores between African American and White Algebra students attending either a high- or low-income high school program (i.e. SES). Of particular interest was whether students from different racial backgrounds who were considered low-income performed similarly on tests; that is to say, whether low-income White students performed differently than low-income African American students. Additionally, this case study sought to determine if affluent African American students performed differently from affluent White students. In addition, this study looked at the data to evaluate performance within racial groups making a general comparison of the Algebra scores of African American students at both schools compared to White students at both schools. Lastly, the current study investigated the use of technology in the TUSD, as it relates to the relationships between teachers and students, along with insight from administrators.

Research Questions

Four research questions were used to guide the exploration of the results.

RQ 1. What are the differences in the Algebra II test scores of students who attend an affluent school vs the test scores of students who attend a low SES school?

RQ 2. What are the differences in the Algebra II test scores of African American students and White students?

RQ 3. Is there an interaction between race and school that impacts test scores?

RQ 4. What are the potential technological factors that influence disparities in the performance of students identified in this study?

Student and School Socioeconomic Status

Understanding SES provides context for the collection and analysis data and set boundaries for both schools (School I and School II) and all groups used in this study. SES for

each school was required to be established if RQ 1 was to be answered. TUSD determines a school's SES based on the percentage of students eligible for the free and reduced lunch program. Figure 3 establishes that for the entire period of analysis, less than 20% of the student population at School I was eligible for free and reduced lunch, whereas over 70% of the students at School II were eligible. Thus, in the context of this TUSD guideline, School I is considered affluent and School II is considered low-income. This was in accord with the NFES (2015), which determines a school's SES by the aggregate of its students' SES and the percentage of those that are thus eligible for free or reduced lunch. NFES (2015) also states that a school's student population is predominantly made up of the neighborhoods surrounding the school; noting that the SES of School I was usually aligned with that of the families populating the neighborhoods wherein the school was set.

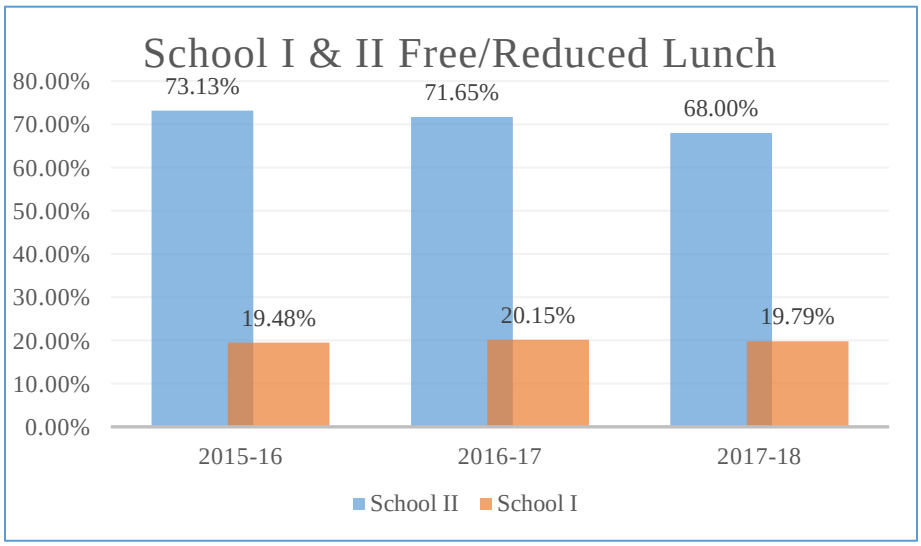

Figure 3. TUSD 2015-2018 student free and reduced lunch rates for School I and School II. Data from the U.S. Department of Agriculture, November 2019.

In addition, Education Demographic and Geographic Estimates (EDGE) tracks poverty by using data received from the U.S. Census Bureau. EDGE, in cooperation with the National Center for Education Statistics, releases a spatially interpolated demographic and economic estimate of neighborhood poverty levels (Geverdt, 2019). Geverdt (2019) explains that the income to poverty ratio estimate (IPR) is a percentage of a family's income that is above the poverty level. He further explains that the IPR ranges from 0 to 999 and that the poverty threshold has a ratio of 100. In Geverdt (2019) 2016-2017 report, the neighborhood surrounding School I had an IPR of 537 with a standard deviation of 79; whereas the neighborhood where School II lies had an IPR of 220 with a standard deviation of 73 (see Table 1).

Table 1

Poverty Statistics

School	IPR Estimate	IPR SD	SES
School I	537	79	Affluent
School II	220	73	Low-Income

Note. IPR = Income to poverty ratio; SD = Standard deviation; SES = Socioeconomic status. Data from National Center for Education Statistics, 2016-2017 School Neighborhood Poverty report.

Ethical Considerations

The current study was approved by the Institutional Review Board (IRB) of the institution of this researcher (see Appendix A) Permission was also obtained from the TUSD and the two schools involved in the data collection. All data was de-identified by the district prior to submitting it to the researcher. No contact was made by the researcher and participants of the study. No data can be attached to any student participant.

Trustworthiness

All data used in this study was received directly from school administrators employed by TUSD. The liaisons working with the schools did not receive payment or benefit for their role in providing the data used in this study. Teachers did not surrender data directly to the researcher, so that there would be violation of the validity of the data. The school administration delivered the data to their designated liaison, who de-identified the data, and submitted it to the researcher for analysis.

Potential Research Bias

Getting past my personal bias based on what I read in the literature was challenging. There was anger and frustration that resulted from the revelations that explained this author's own difficulties with learning and testing. As the understanding expanded, the anger increased, and the efforts to remain objective became an exercise that was ultimately conquered by the understanding of the good that would and could result from this research. If there are any future limitations, it will be that many will not be able or willing to subdue their own biases. As an African American college student, the performance of African American high school students ignites a passionate interest.

It is challenging at times to distinguish fact from fury when the data portrays negative trends of unfairness that have been deemed to have negatively impacted, not only one's children but also one's entire demographic. There is a tendency to insert oneself into the sample and react to victimization by being overwhelmed with the relative emotions, propelling the researcher into defense mode. The reliability of research data gathered when clouded by emotions should be questioned. Nevertheless, research is a continuous activity that should not pause or be detoured by personal emotions. Knowing one's biases as a researcher provides an awareness necessary to

prevent the invalidation of research data. However, to get past the bias, this researcher allowed himself to acknowledge it, be impacted by it, and then to strategically arrive on the other side of it as a researcher and not a subject of this research. This researcher was then able to focus on the data.

Research Design

Case Study Approach

This study measured the performance of African American and White economically impacted high school Algebra II students within the boundary of TUSD on end-of-course exams and explored the impact of the use of technology. A comparative case study approach was selected to make a thorough evaluation of test scores received by high school Algebra II students. The use of a case study provides a different perspective to some who wonder if the BWTSG persists and why test scores are not consistent across racial lines for all students. Yin (2014) states that there is no formula for deciding if a case study method would be ideal for one's research. Nevertheless, he suggests consideration of the case study method to evaluate research questions seeking to provide an understanding of a phenomenon by addressing the how and why or to give an in-depth description or understanding of said phenomenon.

The use of a case study methodology, using both quantitative and qualitative methods, was ideal as it provided the ability to examine the phenomena of BWTSG through the lens of two schools—one in an affluent area and the other in a low-income area—within the single school district of TUSD. The current study quantitatively assessed student academic performance data of Algebra II end-of-course test scores and qualitatively investigated the use of technology via questionnaires.

Creswell (2009) advocates a concurrent embedded design as depicted in Figure 4, where both quantitative and qualitative collection of data occur during the same phase of the collection process. It is a form of mixed methods where a broader perspective is gained through the use of both qualitative and quantitative methods. In this case study, it was necessary to use a concurrent design because of the unpredictable nature of the submission of data by TUSD. While waiting for requests to be answered and data received to answer RQ1, RQ2, and RQ3, that time was used to create and submit surveys to gain qualitative data to address RQ4.

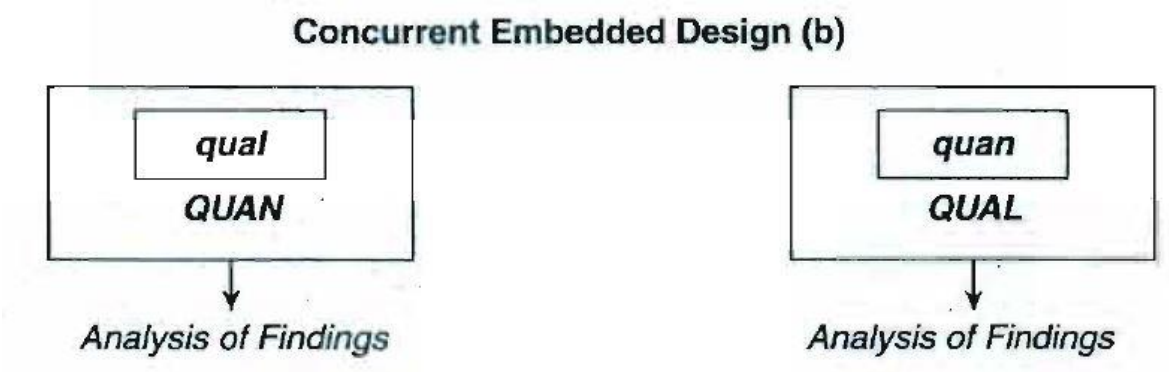

Figure 4. Concurrent embedded design. Research design used for the current study. (Creswell, 2009).

Data Collection

This section discusses the collection of data that was used to evaluate the RQs in the current study.

Setting of Study

TUSD was used as the site for this research because it allowed for a comprehensive assessment of the BWTSG phenomenon within a single local setting. In addition, the administration at TUSD was open to exploring a rather controversial phenomenon, so TUSD represented a convenience sample.

Huicochea (2016) published an article that revealed TUSD initiating a pilot project introducing 1,300 laptops for three schools (including School II). Additionally, 600 computers, and mobile computer carts with power strips and headphones distributed to another 21 schools in TUSD. She states that during the 2016 academic year an additional $4.5 million was approved to purchase an additional 8,100 laptops and other equipment for 71 schools. This move to distribute technology throughout the district was a part of a desegregation order issued 40 years ago (Huicochea, 2016). So began the transitional process of using learning technologies in TUSD classrooms. The data collected for this case study reflected the response to this compliance. The impact of the response may be reflected in the results revealed in the analyzed data.

Subject Area Selection

The chosen subject area for examination in the current case study was Algebra II. Algebra II was chosen for the purpose of this comparative case study based upon the results from one of the surveys administered to high school educators in TUSD during the qualitative data collection process for the current study. The responses to this questionnaire indicated a significant belief among those surveyed that mastery of mathematics curriculum requires more collective cognitive skills than language arts, science, social studies, or history.

Gravemeijer, Stephan, Julie, Lin, and Ohtani (2017) believe that math prepares students for life and work. The U.S. Department of Education (2018) reports that STEM courses are not available to all students; noting that nationally Algebra I was not offered in only 14% of high schools, 16% did not offer Geometry and 20% did not have Algebra II. The report further documents that math and science courses were offered at lower levels in more than 5,000 U.S. high schools with an excess of 75% Black and Latino student population.

Study Approval Process

This researcher presented the proposed research project (Appendix B) in a meeting with the Superintendent and the Assistant Superintendent of TUSD. In this meeting, appropriate schools were identified, based upon the purpose of this case study. Upon approval from the superintendent and the assistant superintendent of TUSD (Appendix C), permission was requested and received from the district's research office and principals from each school (Appendix D). Contacts at the selected schools were also provided to continue the approval process. Subsequently, the designated individuals at each school were contacted, meetings were scheduled, and authorization documentation was signed. During the meeting with the contact persons for each of the designated schools, the specific classes and course educators were also identified and the demographic and SES representation of students in each course were discussed.

IRB authorization was also obtained. The IRB request was submitted in January 2019 and approved in April 2019.

Quantitative Data Collection Process

After the study was approved by the district, the process for collecting quantitative student performance (scores) began with the identification of persons at each participating school that would serve as a point of contact (POC) for data requests. The assistant superintendent also referred the researcher to TUSD's Office of African American Student Services (OAASS). The director of OAASS volunteered to serve as a POC to liaise with the district's research project

manager. Both school POCs were principals. At meetings with each principal, the assistant principals delegated the responsibility to obtain and submit the data to the researcher.

To initiate the process at School I, a meeting was scheduled that included the researcher, assistant principal, and two Algebra teachers. However, at School II, the assistant principal was the only person to meet with the researcher, but she did identify the teachers of Algebra classes from whom she would obtain data. Finally, to obtain historical data, a meeting was set with the Director of OAASS. The Director volunteered to obtain all additional data not received from either school or to follow-up with the POCs, if needed.

There were multiple delays and telephone calls were made to the POCs to get the data flowing again. At both schools, there were times that phone calls were not productive. When this occurred, appointments were made, or a call was placed to the Director of OAASS. There were times that none of these efforts produced data and a call was placed to the Assistant Superintendent. Unfortunately, with all efforts exhausted, there remained some requests that were unfulfilled. The reason for some unfulfilled requests were (a) regulatory, (b) availability, (c) sensitivity to student anonymity, or (d) remain unknown.

Data Specifications

To ensure all participants were protected and to avoid violating the integrity of the research study due to personal bias or ethical considerations, specific instructions were given to those submitting student data to use the following guidelines:

- Math: Collect data from 10th, 11th, and 12th grade Algebra II courses offered at each school for the same academic years (2016-2017 to 2018-2019).
- Data: The only data needed were test scores/results for the second semester Algebra II course.

- Students/Subjects: The data needed to cover all semesters/sessions for academic years 2016 through 2019, including student race, and contain no personally identifiable information. It should be noted that the Tucson, Arizona population contains a low percentage of African American citizens (5%). Therefore, it was necessary to ensure the classes that were selected for the study contained a sample size that was large enough to represent the school's African America student population.

The data were categorized by school, years attended, semester, race, and course. School I data included a total of 174 Algebra II students, 63 of whom were African American. School II student data was comprised of 300 Algebra II students, 40 of whom are African American.

Quantitative Data Transmittal

All data were requested and delivered via email and were stored on the researcher's laptop under password protection. The data were submitted after the removal of any and all personally identifiable information. There were delays in receiving some requested data; however, the final set of data was received on November 14, 2019.

Qualitative Data Collection Process

Another focus of this case study was the use of technology in TUSD, which was studied using qualitative data. For the qualitative portion of this study, two separate questionnaires were used to determine how the introduction of learning technology into TUSD's classrooms has affected teacher and student relationships, as well as to gather insight from administrators. One additional questionnaire was used to determine the subject area chosen for this case study.

To test the reliability of the questionnaire instrument, Cronbach's alpha was used. The results (shown in Table 2) demonstrate a high level of reliability, which begins at .70. Construct validity of the administrator questionnaire instrument was verified with a value of .95 and the

teacher questionnaire was verified with a value of .97, which demonstrates excellent internal consistency among survey questions.

Table 2

Cronbach's Alpha Reliability Test for Teacher and Administrator Survey Questions

Instrument	Validity	# of Questions	Excluded	Respondents	CA Reliability	Reliability Level
Teacher Questionnaire	97.1%	5	1	34	.97	Excellent
Administrator Questionnaire	100%	4	0	11	.95	Excellent

Note. # = Number; CA = Cronbach's alpha.

The invitations to complete the questionnaires were sent via email and direct FaceBook Messenger. These invitations were sent to 150 teachers and 100 administrators, all from TUSD. Although both the Teacher and Administrator questionnaires consisted of five questions, only the last four were used to obtain data to respond to RQ3. Question number 1 was used to categorize the respondents to determine if their perception varied relative to the length of their teaching experience at TUSD.

Teacher Survey Questions

The following questions were used to gather data to answer RQ 4, which seeks to determine if technology has influenced teacher student relationships in such a way as to have affected their performance.

1. How long have you taught for TUSD?
2. Since technology was introduced as a learning and teaching tool for use in TUSD classrooms have students become more interested in learning?
3. Since technology was introduced as a learning and teaching tool for use in TUSD classrooms have teachers become more engaged with students?

4. After technology was introduced as a learning and teaching tool for use in TUSD classrooms were teachers more motivated to teach?
5. After technology was introduced as a learning and teaching tool for use in TUSD classrooms were students less distracted?

Administrator Survey Questions

Although administrators are not being investigated, their direct observation of the response of students and teachers toward technology was also used to answer RQ 4.

1. How long have you been employed by TUSD?
2. Since technology was introduced as a learning and teaching tool for use in TUSD classrooms has there been less turnover among faculty and staff?
3. Since technology was introduced as a learning and teaching tool for use in TUSD classrooms have teachers become more engaged with their students?
4. After technology was introduced as a learning and teaching tool for use in TUSD were classrooms teachers more stable?
5. After technology was introduced as a learning and teaching tool for use in TUSD classrooms teachers are more motivated to teach.

Three-Question Curriculum Survey for Teachers

A small group of educators answered online survey questions (via surveymonkey.com) that were used to determine the subject area to be explored in the current case study. An invitation to complete the survey was sent to 30 teachers via email and Facebook Messenger.

The invitation was also posted to a Facebook group consisting of teachers and other education personnel. The invitation resulted in 20 responses. The three questions on this survey were:

1. Which academic subject most accurately reveals a student's ability to read with comprehension?
2. If your student could only use one course to prepare for a standardized test, which would you suggest?
3. Which subject requires the use of multiple cognitive skills?

To test the reliability of this questionnaire, Cronbach's alpha was used. The results demonstrate a high level of reliability, which begins at .70. Construct validity of the administrator questionnaire instrument was verified with a value of .95, which demonstrates excellent internal consistency among questionnaire questions (see Table 3).

Table 3

Cronbach's Alpha Reliability Test for Curriculum Survey Questions

Instrument	Validity	# of Questions	Excluded	Respondents	CA Reliability	Reliability Level
Curriculum Survey	100%	5	0	11	.96	Excellent

Note. # = Number; CA = Cronbach's alpha.

Data Analysis

According to Cooper and Schindler (2006), there are only primary and secondary sources of data. This case study used both primary (student test scores, questionnaire, and survey responses) and secondary (federal, state, and local information relative to TUSD) sources of data to address the research questions explored in this case study. TUSD student data was used to determine differences in the academic performance of White and African American students. Survey responses were used to evaluate the influence of learning technology on teachers and

administrators, their relationships with student, and with each other. The data received from the State and other government entities were used to examine the socioeconomic demographics of each school.

SPSS was used when analyzing the quantitative data, which compared the test results of affluent with low-income White students and low-income with affluent African American students. An ANOVA seemed appropriate to compare the effects of two qualitative variables (race and school) on a quantitative dependent variable. Although regression could have been utilized, the research questions did not require a prediction of scores using race and school, but instead could be satisfied with confirming whether or not there is a difference between the groups. SPSS was also used to conduct pairwise and ANOVA comparisons of four groups (affluent, low-income, African American, and White). The groups were in two categories (School I and School II). An ANOVA was performed comparing all groups against each other and among each other. In addition, a univariate analysis of the data was run, which included Levene's test of equality of variances. The analysis determined significant differences or interactions between race, school, and performance at each school and between each school. A pairwise comparison was also used to determine any significant differences.

Table 4 shows the analysis process that was used to produce the findings and results that are discussed in the next chapter.

Table 4

Case Study Analysis Process

Questions	Steps	Elements
What data was collected and to which RQ does it apply?	Prepare data for analysis	Assign data to applicable research question or variable
Can the data be summarized?	Describe data, identify and summarize variables	Frequency tables, figures, descriptive output; any coding, charts, diagrams
Can the association between variables be determined?	Analyze associations between variables	Output, data sheets, raw data, analytic cross tables
Are there differences in the performance of African American and White students attending an affluent school?	Determine the type of statistical analysis	Choose significance tests (pairwise, *t*-tests, ANOVA, etc.)
Are there differences in the performance of African American and White students at a low-income school?	Determine the type of statistical analysis	Choose significance tests (pairwise, *t*-tests, ANOVA, etc.)
Are there differences in the performance of African American students attending an affluent school and those attending a low-income school?	Determine the type of statistical analysis	Choose significance tests (pairwise, *t*-tests, ANOVA, etc.)
Are there differences in the performance of White students attending an affluent school and those attending a low-income school?	Determine the type of statistical analysis	Choose significance tests (pairwise, *t*-tests, ANOVA, etc.)
Can results be clearly understood in relation to variables and research questions?	Create visual aid to provide clarity of analysis.	Chart, flow chart, diagram, etc.
Are survey and questionnaire questions reliable?	Test reliability of all survey and questionnaire questions.	Use Cronbach's Alpha via SPSS.
Are there any common patterns or themes arising from survey and questionnaire questions?	Categorize all responses; classify, summarize, and tabulate the data; note arising patterns and themes.	Use manual content analysis, NVivo, or Stata/IC 16.

Summary

The methodology and design of this case study were relativistic and epistemological for the purpose of studying the differences between African American and White students' test

scores and demographic variables in the schools. Quantitative student performance data was gathered from two schools of opposite socioeconomic regions in the TUSD (School I and School II). The participants were high school Algebra II students. Qualitative data from teacher and administrator responses to surveys were also collected. Chapter 4 presents the research findings of this case study.

CHAPTER 4

RESULTS OF THE STUDY

Introduction

In the previous chapter, the collected data, process of collection discussed. This chapter discusses the quantitative findings and qualitative results based upon the data collected and analyzed for this comparative case study.

The purpose of this comparative case study was to explore the issue of the BWTSG by comparing the academic performance of economically impacted White and African American students in two TUSD high schools. The schools used in this research were School I, which was set in an affluent region of the district and School II, which was set in a low-income region. Discussions of the analysis of the three-question curriculum survey, the quantitative student scores, and the qualitative teacher and administrator questionnaires follow.

Analysis of Curriculum Survey Responses

A three-question curriculum survey was used to determine which academic subject would be the focus for this case study; SPSS was used to test the reliability of this survey. The responses to this curriculum survey reveal that course offerings were similar at the two schools, with some higher-level math courses offered at the affluent school and some lower-level math courses offered to students attending the low-income school. Incidentally, there were course offerings that were common to both schools: namely Algebra I, Algebra II, Honors Algebra II, College Algebra I and College Algebra II, Pre-Calculus I, Geometry I, Geometry II, and Honors Geometry. However, these courses varied greatly in their representation of African American students with some having less than 10 students. When all courses were reviewed for the purpose of analysis, all courses that were not common to the variables of race, school, and grade level

were removed. Thus, the second semester Algebra II course was selected. Furthermore, due to the low number of African American students in a single math class, this study combined data from 10th, 11th, and 12th grade Algebra II students at both schools.

Analysis of Quantitative Data

The objective for this analysis was to evaluate the data relative to the academic performance of affluent African American and White students and low-income African American and White students in in Algebra II courses in Grades 10, 11, and 12 in TUSD. The scores used as data for the quantitative analysis were an accumulation of second semester end-of-course test results earned by students attending School I and School II during the academic years of 2016 through 2018. The site of these groups has been identified as School I for affluent students and School II for low-income students. After the data were collected, pairwise comparisons and a univariate ANOVA using SPSS were conducted. Although standardized test scores have been used to determine the variance nationally found in the BWTSG, exploring test results in light of the variables of affluence and low SES should deepen such discussions locally.

The test scores were examined via SPSS (version 26) to determine if the performance of African American Algebra II students attending School I varied from the performance of African American students attending School II. The data were also analyzed to determine if White high school Algebra II students attending School I varied from White Algebra II students attending School II. There were also comparisons of student performance between groups attending the same schools. These comparisons provide for an examination of performance results of students of different races who had similar SES at both schools.

Two surveys were utilized to evaluate the impact of the use of technology on teacher student relationships and administrator observations in TUSD classrooms since 2016. SPSS was

used to test the reliability of the questions in these two surveys, while content analysis was used to analyze the qualitative data.

Quantitative Findings

Findings from the analyses of quantitative data were investigated for answers to the RQs that underpinned this case study. Each RQ is presented with associated discussions about the findings following.

Summary of Previous Findings

The goal of the previous research was to investigate School I and School II using the topic of inquiry *Can the use of learning technologies in Tucson Unified School District classrooms contribute to improved academic performance in African American high school students.* Between both schools three categories emerged from the analysis: (a) African American; (b) White; (c) Other. These categories were analyzed by the review of documented performance results.

The following were the previous research questions answered by previous data.

RQ 1. *Is there a difference in the Algebra I mid-year course standards assessment scores of students who identify themselves as African American when compared to the scores of students who identify themselves as White?*

The first research question sought to determine if there was a variance between African American students and White students in Algebra I at the participating TUSD high schools. Using the sample at School II, the research indicated that there was no significant difference in the performance of African American and White students on the mid-year assessment, as depicted in Table 1. The African American Algebra I group (N = 17) was associated with M = 58.35 (SD = 18.26). By comparison, the White Algebra I group (N = 25) was associated

with M = 59.36 (SD = 20.56). To test the hypothesis determining if there was a difference in the Algebra I mid-year course standards assessment scores of students who identify themselves as African American when compared to the scores of students who identify themselves as White, an independent sample t-test was conducted. As can be seen in Table 5, there was no significant difference in the performance of N = 7 and N = 25.

Table 5

Algebra I Group Statistics for School II

	African American	White
Mean	58.35	59.36
Standard Deviation	18.258	20.559
	Levene's Test of Equality of Variances	
Significance	.552	No significant differences

Note. Mid-year assessment scores were used. Independent samples t-test results showing no significant differences in African American and White student Algebra I scores at School II.

RQ 2. *Is there a difference in the Algebra II mid-year course standards assessment scores of students who identify themselves as African American when compared to the scores of students who identify themselves as White?*

The second research question sought to determine if there was a variance between African American students and White students in Algebra II in TUSD. Using the sample at School II, the research indicated that there was no significant difference in the performance of African American and White students on the mid-year assessment.

The African American Algebra I group (N = *16)* was associated with M = 53.44 (SD = 22.90). By comparison, the White Algebra II group (N = 26) was associated with M = 59.36 (SD = 21.22). To test the hypothesis determining if there was a difference in the

Algebra I mid-year course standards assessment scores of students who identify themselves as African American when compared to the scores of students who identify themselves as White, an independent samples *t*-test was conducted. As can be seen in Table 6, there was no significant different in the performance of African American and White students at School II.

Table 6

Algebra II Group Statistics for School II

	African American	White
Mean	53.44	60.81
Standard Deviation	22.91	21.22
	Levene's Test of Equality of Variances	
Significance	.72	No significant differences

Note. Independent samples *t*-test results showing no significant differences in African American and White student Algebra II scores at School II.

School I did not have a sufficient African American sample size for the data collected from one test to run statistical tests, therefore only School II data was analyzed. This case study made adjustments to the sample and the following research questions to investigate the same phenomenon, the BWTSG, with a new topic of inquiry.

Discussion of Research Questions

The following research questions were answered by the data collected for this case study.

Research Question 1

RQ 1. *What are the differences in the Algebra II test scores of students who attend an affluent school versus the test scores of students who attend a low SES school?*

This question sought to understand how SES affects the performance of students in Algebra II. To answer this question, a univariate analysis was conducted on the scores of African American and White students from both schools. The analysis results in Table 7 show that there was neither a significant difference in the scores of affluent African American and White students at School I nor low-income African American and White students at School II.

Table 7

Pairwise Comparisons of Affluent and Low-Income Schools on Scores in Algebra II

Participating Schools	Mean Difference	Significant Difference
School I versus School II	-8.801	Yes
Affluent versus Low-Income	-8.801	Yes
Total	-8.801	.000

Research Question 2

RQ 2. *What are the differences in the Algebra II test scores of African American students and White students?*

In an effort to answer this research question, a *t*-test was performed on the test scores of all African American and White Algebra II students. Table 7 shows that there was no significant difference in the overall performance of these two student groups. Found in the descriptive statistics in Table 8, African Americans at School I scored higher than all other groups with a mean difference of 77.6, including White students at School I whose mean was 72.11. In fact, all groups (African American and White students at School I and White students at School II) were within the 70th percentile. Only African Americans at School II, whose mean difference was 58.50, underperformed. This score is substantially less than the African Americans at School I by 19.10 points.

Table 8

Independent Samples t-Test Comparing all African American Student Performance with all White Students at School I

Student Participants	Sample Size	Mean Difference	Significant Difference
African American	103	77.64	No
White	371	72.11	No
Total	474	5.53	.71

To validate these findings, a Tukey analysis was run with the groups separated along racial lines to investigate significance (Table 9) and an ANOVA multiple comparison was run to compare means. In these operations, each group was separately compared to the other groups for a total of four comparisons. The comparisons are made for (a) school, (b) African American students and White students, (c) School I Algebra II classes and (d) School II Algebra II classes.

Table 9

Significance Table from Tukey Analysis Comparing Performance by Race

Racial Identity	School I AA	School I W	School II AA	School II W	Significance
School I AA		.11	.00	.24	With School II AA
School I W	.11		.00	.83	With School II AA
School II AA	.00	.00		.00	With All
School II W	.24	.83	.00		With School II AA
Significance	None	None	All	None	

Note. AA = African American; W = White.

The null hypothesis in this question was that the scores would be equal across the groups between schools was tested; however, the Levene's test of equality of variances was violated.

Research Question 3

RQ 3. *Is there an interaction between race and school that impacts test scores?*

A factorial ANOVA was conducted to determine if there is a difference in the academic performance of African American and White students in School I and School II (See Table 10 for descriptive statistics).

Table 10

Descriptive Statistics for all Groups

	School I			School II		
	n	*M*	*SD*	*n*	*M*	*SD*
African Americans	65	77.60	10.56	40	58.50	19.50
White	109	72.11	15.98	260	73.61	15.44

Note. $N = 474$.

A two-way ANOVA was conducted that examined the effect of race and school on score in Algebra II. The results demonstrate that there was a statistically significant interaction between the effects of race and school on score, $F(1, 470) = 5.620$, $p = .001$ (see Figure 5).

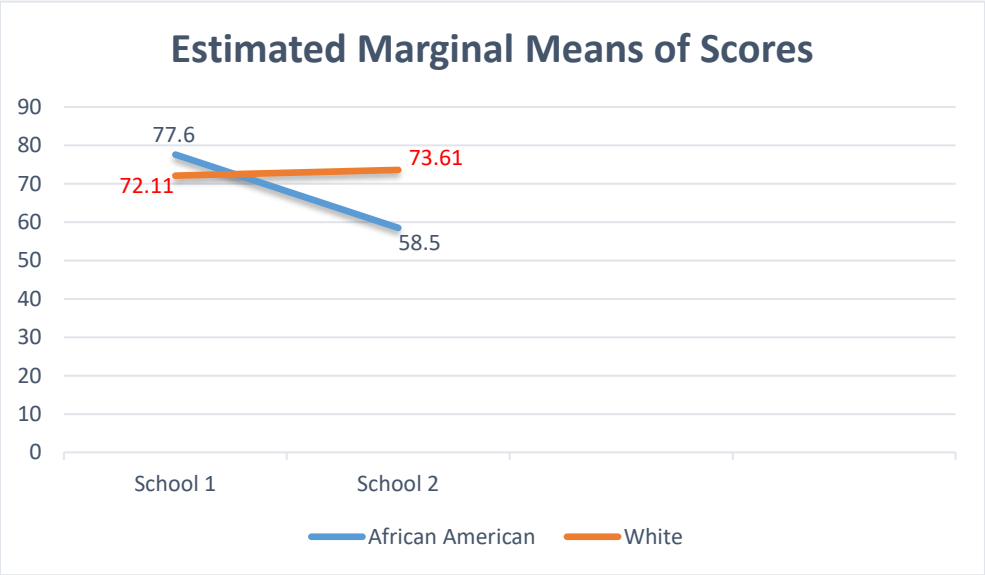

Figure 5. Chart of interaction between independent variables with means scores as the dependent variable.

Research Question 4

RQ 4. *What are the potential technological factors that influence disparities in the performance of students identified in this study?*

Administrator and Teacher Questionnaire results were used to address RQ 4.

Administrator Questionnaire Results

The administrator questionnaire (AQ) of five questions received 11 replies from 100 invitations that were sent district-wide. Question 1 was removed from analysis due to relevance. Forty-five percent of the respondents were one- to five-year employees and more than 55% were employees with at least six to more than 10 years of service. The responses were analyzed using content analysis and the results are shown in Table 11. The results reflected relevant data to this study as it explored three academic years (2016-17, 2017-18, and 2018-19).

AQ 1: Question 1 was removed from the set, as it had no relevance to administrators. Cronbach's Alpha was re-run for the remaining four questions used to set context to the responses of the following questions.

AQ 2: Since technology was introduced as a learning and teaching tool for use in TUSD classrooms has there been less turnover among faculty and staff?

The responses to AQ 2 revealed that nearly half (45.45%) of administrators agree that they have observed an increase in retention of teachers since technology was introduced into their classrooms. Only 36.36% disagreed, with 18.18% remaining neutral on this question.

AQ 3: Since technology was introduced as a learning and teaching tool for use in TUSD classrooms have teachers become more engaged with their students?

For AQ 3, there was a strong response in disagreement to the assertion (27.27%), with 18.18% remaining neutral. Even so, in response to AQ 3, Table 11 shows that more than half the

administrator respondents, 54.55%, agreed teachers have become more engaged with their students since they began using technology for instructional purposes. A theme of teacher engagement also arose from these responses. Due to the response of administrators in strong disagreement, contact was made by this researcher with two of the known administrative participants. The administrators, both from School I, stated that their teachers have always maintained a high level of engagement with their students.

AQ 4: Since technology was introduced as a learning and teaching tool for use in TUSD classrooms have teachers become more stable?

The results for AQ 4, depicted in Table 11, reveal that although less than 10% (9.09%) disagreed that teachers have become more stable in their positions since technology was introduced into their classrooms, nearly half, 45%, neither agreed nor disagreed. However, 45% were in agreement showing four of the five to agree with School I administrators.

AQ 5: Since technology was introduced as a learning and teaching tool for use in TUSD classrooms are teachers are more motivated to teach?

AQ 5 considered the administrator's opinion of the motivation of their teachers to teach after the introduction of technology into their classrooms. Fifty-five percent of respondent administrators agreed (two at School I and four at School II, shown in Table 11), while 27.27% strongly disagreed and 18.18% remained neutral. Increased teacher motivation was seen as a theme in these responses. While discussing strong disagreement to these questions, administrators at School I reveal that their teachers have not wavered in their motivation to teach.

Table 11

School I and School II Administrator Questionnaire Results and Analysis

Question 2	Turnover	Response	School I	School II
1	Strongly agree	45.45%	3	2
2	Agree			
3	Neither	18.18%	1	1
4	Disagree	27.27%	1	2
5	Strongly disagree	9.09%		1
Question 3	Teacher Engagement	Response	School I	School II
1	Strongly agree			
2	Agree	54.55%	2	4
3	Neither	18.18%	2	
4	Disagree			
5	Strongly disagree	27.27%	3	
Question 4	Teacher Stability	Response	School I	School II
1	Strongly agree			
2	Agree	45.45%	4	1
3	Neither	45.45%	2	3
4	Disagree			
5	Strongly disagree	9.09%		1
Question 5	Teacher Motivation	Response	School I	School II
h	Strongly agree			
2	Agree	54.55%	2	4
3	Neither	18.18%	2	
4	Disagree			
5	Strongly disagree	27.27%	2	1

Teacher Questionnaire Results

To explore the influence of technology on the performance of their students, 100 teachers were asked five questions via SurveyMonkey and 34 responded. The responses to this questionnaire reveal teacher involvement with, and observation of, their students after technology was introduced into the classroom as a learning and teaching tool.

To test the reliability of this questionnaire instrument, Cronbach's Alpha was used. The result, shown in Table 10, portrays a high level of reliability, which begins at .70. Construct validity of the teacher questionnaire instrument was verified with a value of .97, which demonstrates excellent internal consistency among teacher questionnaire questions.

Discussion of the responses to the five questions in the Teacher Questionnaire (TQ) follow.

TQ *1: How long have you taught for TUSD?*

More than half, 55.88% of the respondent teachers had been teaching for TUSD for five years or less, 23.53% had been employed there for 6-10 years and the remaining 20.59% had taught in TUSD for more than 15 years (see Table 12).

TQ 2: Since technology was introduced as a learning and teaching tool for use in TUDS classrooms have students become more interested in learning?

When asked if their students were more interested in learning after technology was introduced only 23.53% agreed, 29.41% were neutral, 32.35% disagreed, and 14.71% strongly disagreed (see Table 12).

TQ 3: Since technology was introduced as a learning and teaching tool for use in TUDS classrooms have you become more engaged with your students?

TQ 3 investigated teacher/student engagement since technology had begun to be used for learning. In agreement was 23.53%, with 29.41% neutral, 8.82% in disagreement, and 14.71% in strong disagreement with this question.

TQ 4: Since technology was introduced as a learning and teaching tool for use in TUDS classrooms are you more motivated to teach?

When asked if they were more motivated to teach, 26.47% agreed and 17.65% strongly agreed, while 35.29% were neutral, 20.59% disagreed and there were none who strongly disagreed (see Table 12). A theme of motivation emerged.

TQ 5: Since technology was introduced as a learning and teaching tool for use in TUDS classrooms have students become less distracted?

The final question in this questionnaire was about teachers' observation of their students' focus since they have been required to use technology in the classroom. When asked if their students were less distracted since the introduction of technology as a learning and teaching tool, 38.24% disagreed and 20.59% strongly disagreed, 23.53% were neutral, none agreed, and 17.65% strongly agreed (see Table 12).

Table 12

School I And School II Teacher Questionnaire Results and Analysis

			School		
Question 1	Experience	Response	I	II	Theme
1	Strongly agree	55.88%	7	12	
2	Agree	23.53%	4	4	
3	Neither				
4	Disagree	20.59%	5	2	
Question 2	Student Interest	Response	I	II	Theme
1	Strongly agree				
2	Agree	23.53%	2	6	
3	Neither	29.41%	6	4	
4	Disagree	32.35%	7	4	
5	Strongly disagree	14.71%	4	1	

(*table continues*)

Table 12 (*continued*)

			School		
Question 3	Teacher Engagement	Response	I	II	Theme
1	Strongly agree	2.94%		1	Teacher Engagement
2	Agree	35.29%	4	8	
3	Neither	38.24%	9	4	
4	Disagree	8.82%	2	1	
5	Strongly disagree	14.71%	5		
Question 4	Teacher Motivation	Response	I	II	Theme
1	Strongly agree	17.65%	2	4	Teacher Motivation
2	Agree	26.47%	2	7	
3	Neither	35.29%	9	3	
4	Disagree	20.59%	2	5	
5	Strongly Disagree				
Question 5	Distracted Students	Response	I	II	Theme
1	Strongly agree	17.65%	2	5	
2	Agree				
3	Neither	23.53%	5	3	
4	Disagree	38.24%	9	4	
5	Strongly disagree	20.59%	7		

In regard to RQ 4, the teacher and administrator questionnaires reveal the beliefs of both groups as it concerns the behavior of teachers and students, as well as the employment of teachers in an academic environment. The responses given may influence disparities or factors that could impact the performance of economically impacted students in schools subject to the qualitative of this case study.

Summary

In this chapter, findings from the quantitative and qualitative data were presented and discussed. The research questions for this case study were also reviewed. The following chapter

discusses the research study as a whole and provides conclusions and recommendations in light of the results of this comparative case study.

CHAPTER 5

DISCUSSION

Introduction

This chapter will introduce the reader to a school district that is not unlike others in this nation, including a discussion of all major findings of this case study as related to the research questions, literature on student SES, the BWTSG, technology in education, and race. During the review of data, implications and associations to the topic of inquiry were also recognized. In this single school district, TUSD, two schools with differing levels of SES were examined and the results of that examination are reviewed. The chapter concludes with a discussion of potential research for the future and a brief summary of critical points reviewed in the discussion section.

The purpose of this comparative case study was to investigate differences in the academic performance of Algebra II students in two schools in the TUSD. One of the schools is set in an affluent area of town, while the other is set in a low-income area. The variables to be investigated were school SES, race (African American and White), and scores of second semester Algebra II exams.

Summary of the Findings

The analysis of data revealed significant differences in the academic performance of students in affluent and low-income schools. African American students at School I scored significantly higher than African American students did at School II; they also had the highest score among all student groups. Furthermore, there was a statistically significant difference in the performance of African Americans at School II and their White peers. The data also revealed a significant interaction in the effects of school and race.

Background

The current comparative case study explored two high schools assessing the performance differences between economically impacted African American and White students in high school Algebra II classes at TUSD. The previous study conducted on the schools that are subject to this case study revealed data that was collected to explore the performance of African American students. The sample size that was mentioned in Chapter 4 for School I as being too small only included a total of two African American students. Unfortunately, the size of the sample was insufficient to run an independent *t*-test to determine a statistical variance.

The education system for K-12 students in Arizona has an overall ranking that is among the lowest in the country. Furthermore, Arizona is in the top 10% for poverty ranking in the nation, coming in 8th at 16.09% (Worldpopulationreview.com, 2020), with Tucson exceeding the state's national ranking at 24.1% (U.S. Census Bureau, 2018). Meier (2004) notes that school funding has not been promoted with equity by the No Child Left Behind Act. Thus, the social environment around African Americans in the state of Arizona is one where the state has not competed in educational spending, ranking in the bottom 10% in per student spending in the nation (U.S. Census Bureau, 2015). Therefore, it is an environment where the problems that are prevalent nation-wide, such as poor performance among African American students, are exacerbated. Forces and factors in their environments that have the most influence over students, such as social activities that involve family and friends, may enhance performance challenges.

School I is located in an affluent area of Tucson, while School II is in an area with less affluence. Ready (2010) explains that there is a link between the SES of a student's family and school attendance. The lack of a significant difference could be a result of the SES of both African American and White students at School II. School II reflects the traditional and known

reality of the BWTSG that is prevalent in most school districts in America that participate in standardized testing. Namely, African American students perform at a lower level on standardized tests than do their White counterparts (Jencks & Phillips, 2011). Reardon (2013) agreed but added that the SES of low-income African Americans adds to the impact of these performance differences.

The results of the current research project support the belief that SES influences results that are consequent to failure for the low-income student attending a low-income school, but success for the affluent students attending schools in an affluent region. In a demographic where there is rampant poverty along with undersupplied schools staffed with ill-prepared and underpaid teachers, expectations are very low, and performance tends to meet those expectations.

Hence, the results for the current case study revealing no significant difference in the performance of African American and White Algebra students on second semester Algebra II tests between schools were not surprising. Furthermore, it was of no surprise that there was no significant difference in the performance of African American and White students at School I.

This researcher assumed, based on the results of the initial study mentioned in the background section of this chapter, that African Americans and White students impacted by low SES would also show no significant difference in their performance results; yet, not only was there a significant difference in the results of the scores of African Americans and White students at School II, but data revealed a significant difference between low-income African Americans and all other student groups in the study.

The literature mentions that unequal distribution of resources could become a factor in the academic performance of students and pointed out that resources available at one school might not be provided to another (Fuchs & Woessmann, 2005). The literature speaks of unequal

distribution of various resources as a key factor when one school out-performs another. Overcoming unequal distribution could result in a positive effect. The literature also addressed the impact of unequal distribution of resources such as these and noted that this practice results in inequitable learning opportunities (Smith et al., 2016), as was possibly the case for School II.

Bangs and Davis's (2014) research in the city of Philadelphia, called Urban Innovation 21, linked communities that are underserved with the growing business sector through technology. This research explored the same type of disconnect from classrooms in low-income communities in TUSD and recommends specific technology to be introduced into urban areas or areas, as was used in School I as mentioned above.

Even with possible inequities in resources, the findings of the analysis of data in this case study revealed superior academic performance by African American students at the affluent school (School I) as compared African Americans at low-income school (School II). Furthermore, White students at the affluent school also performed significantly above African American Students at the low-income school; however, it is no surprise that White students at the low-income school also performed significantly above their African American peers. A relevant question to consider is, would a change in the environments of White and African American students at the low-income school have reversed the test results?

This study suggests that there is a problem in TUSD that parallels the one in the United States regarding academic performance between African American and White students. What is not clear is why this achievement gap exists, beyond the difference in SES and associated factors, such as those mentioned in the literature (i.e. unequal learning opportunities, and changes in the learning environment).

Interpretation of the Findings

Assumptions Revisited

In Chapter 1, four assumptions were introduced as foundational considerations for this multiple comparative case study. This discussion will address those assumptions in light of the research findings. It is important to understand the thoughts of the researcher and what was considered prior to the findings strengthen the validity and integrity of the findings.

Firstly, it was assumed that African American student sample sizes would be small due to there being only a 5% representation of the demographic in both the city and state's population. The researcher assumed this would impact the ability to obtain an adequate sample to represent the student population at School I due to its geographic location in the city. This led to the second assumption, which considered the student population.

It was assumed that the students attending each school were primarily from the geographic area wherein the schools are located. This assumption carries with it the supposition that the economic composition of the families in the school's vicinity qualify them to live in those areas. An implication present in this assumption suggests a relative SES for the enrolled student. Alexander et al. (2007) would support this idea, as they taught that families lived in neighborhoods that reflect their SES and school their children accordingly. Furthermore, in the literature, Geverdt (2019) explained the IPR that places School I in a neighborhood that is considered affluent and School II is in a low-income neighborhood. This assumption could have impacted a student's access to and use of learning technology, which leads to the third assumption.

It was also assumed that the student participants in this case study were relatively impacted by the SES of the neighborhoods in which the schools are located. Thus, Huo (2019)

would support a theory that higher affluence of students had a positive impact on their academic performance. Owens (2016) explained that affluent students benefited from being raised in an environment where education was part of the family's investment, whereas Monroe-Lax and Ko (2017) contended that low-income students performed in accordance with factors relative to their low SES. Thus, this assumption was realized in this study.

Finally, it was assumed that the classroom technology that was available to students at either school was available for all students sharing the classroom. This assumption was considered because Banks (2010) contended that students with low SES are likely to attend schools with inadequate resources. Thus, this researcher assumed that both groups at School II would reveal lower scores than both groups at School I. The results did not bear this out.

Objective

This case study intended to determine if there was variance in the academic performance of affluent and low income African American and White students, as well as to discover how low-income schools differed from affluent schools. The idea was to explore the influence of SES on the students and their schools. This objective was met as revealed by the results of data analyzed in Chapter 4, with a difference in the Algebra II test scores registered by both schools and a significant difference in the scores of African American students at School II and all other groups. The literature confirms that affluence and poverty impacts student performance (Ready, 2010; Thum & Hauser, 2015).

Hypotheses

There were three hypotheses that influenced this study. A discussion on the impact of the case study results on each hypothesis and the connections to the literature follow.

- *African American students at an affluent high school did not have lower scores on second semester Algebra II exams than their White peers.*

This was assumed because of the results of analysis performed in a previous study shown in Chapter 1. Although there was not enough data to substantiate the analysis, the data that was received revealed that African American students in that study produced higher scores on the mid-year Algebra assessments than did their White peers. The low enrollment of African Americans in this affluent school is not uncommon. Owens (2016) believed African American students from families who have higher SES do not always have access to schools attended by other races who have a similar SES, due to the location of their homes. Owens (2016) explained that for those students who do have this access, the statistics do not show an achievement gap.

Alexander, Entwisle and Olson (2007) disagreed with Owens when they claimed that wealthy families tend to live in affluent neighborhoods and send their children to better schools. To overcome the small African American student population at the affluent school multiple years of data was collected for Algebra II and analyzed. The results were in line with Owens's (2016) findings, in that there was no achievement gap between the races at the affluent school. Thus, this hypothesis was found true in that African American students did not have lower scores than their White peers.

- *African American and White high school students who are economically impacted by affluence perform on the same academic level in Algebra II.*

As explained in response to the first hypothesis, African American students did not receive lower scores than White students at the affluent school. In fact, African American students received higher scores. Having received higher scores, there was no gap as is seen in the BWTSG phenomenon.

- *African American and White students who are economically impacted by poverty perform on the same academic level in Algebra II.*

This hypothesis guided the researcher to perform multiple analyses: four-way ANOVA, pairwise comparison, and an independent samples *t*-test. The results for this hypothesis were supported by the data.

Research Questions

There were four RQs that underpinned this study. A discussion on the impact of the case study results on each RQ and links to the literature follow.

RQ 1. What are the differences in the Algebra II test scores of students who attend an affluent school versus the test scores of students who attend a low SES school?

In terms of the first research question, which investigated the differences in the academic performance of affluent and low-income schools based on Algebra II scores of four groups of student participants, the data confirmed that there was no difference in the means between schools. However, this does not indicate that there was no difference in the academic performance between participant groups.

Circling back to the literature, School I was identified as affluent since less than 20% of its student population are eligible for the free and reduced lunch program for academic years 2016-2019. Moreover, Geverdt (2019) reported that the neighborhood wherein School I was located was considered affluent based on the percentage of the resident family's income that was above the poverty level. Using the same scale, Geverdt (2019) described School II as low-income. To add, information about School II showed that more than 70% of the student population were eligible for free and reduced lunch over the same academic years.

The literature informed that families with wealth schooled their children in good schools according to their SES. Yet low-income families usually enrolled their children into schools in their geographic areas which usually have fewer resources even though they would have liked to send their children to better schools (Alexander et al., 2007). Unfortunately, the authors explained, for low-income families, resources were not as available or sufficient and the teachers were not as experienced or qualified. According to the Every Student Succeeds Act, schools with high student poverty rates require state and district funding to produce quality instruction (Darling-Hammond et al., 2016; Every Student Succeeds Act, 2015). However, School I did receive at least one resource that was not available at School II. Nevertheless, it is not concluded that the unequal distribution of technological resources was primarily responsible for the results found in this case study. However, a future study should be conducted investigating this possibility. This is in line with previous research conducted by Langevin (2015), who found that low-income schools could have all the right pieces in place—instructors, equipment, technology, and funding—and students would still perform below those in affluent schools. Some factors mentioned in previous research that may have contributed to academic performance of students in this case study were (a) financial investment, (b) early access to learning technology in the home, and (c) a family's focus on education (Kornich & Furstenberg, 2013; Monroe-Lax & Ko, 2017).

School I. The results for School I revealed that there was a surprise in the variance in the performance between African American and White students who were of a high SES. This finding is in contrast with Huo (2018), who investigated the academic performance of affluent students and found no variation in their results. McClure (2008) claimed that teachers employed at affluent schools received better pay and were more qualified, more experienced, received

better training, and had better tools. That being said, TUSD and the state complied with federal requirements to support all schools; however, they may have provided some technological resources to School I that were not available to School II, and vice versa. It is unknown whether or not this somehow influenced the variance between participant groups at either school. It should be noted, however, that African American students at School II scored significantly lower than all other students. Whereas, African American students at School I scored higher than all other students, and much higher than African Americans at School II. Nelson, Trygstad, and Banilower (2013) recognized that in many districts there is an unequal distribution of talented teachers. It is possible that School I had better, more qualified, and more experienced teachers, which could have been responsible for the performance gap between School I students and School II African American students. Although the data revealed that there was no significant difference when considering both student groups at School I and White students at School II, there was a significant difference in the performance of African American students at School II when compared to both groups at School I. This could be attributed to the factors associated with low SES of student and school, such as environment, self-efficacy, resource distribution, student interest, teacher skill, and student/teacher engagement performance (Monroe-Lax & Ko, 2017). Teacher responses, when asked about student interest at School II, revealed that only six of 15 teachers believed their student's interest in learning increased during the academic period of this case study.

School II. The equality of means between the affluent and low-income schools in this case study may be understood by discussing the performance of the student groups. African American students at this school performed below their White peers. However, based on the fact that there was no significant difference in the performance of White students and the

performance of the students at the affluent school, the White students may have benefited from the adjustments made in compliance with the ESSA. Milner (2012) believed that students of color lacked learning opportunities and suffered from a neglect of the acknowledgement of a demographic divide between student and teacher. Questionnaire results from this study, however, revealed that 45% of TUSD administrators strongly agreed that turnover had decreased during the academic years of this case study (2016-2019). Three of these administrators were at School I and two were at School II. Furthermore, 55% agreed that teacher-to-student engagement had increased, and teachers were more motivated to teach. Four of six of these administrators were at School II. This could imply that School I was consistently engaged with their students and due to the level of engagement and motivation prior to the introduction of technology, there was very little-to-no change in their teaching practice. It could also imply that administrators gave their teachers the support they needed to incorporate computer technology into their classrooms. as mentioned in the literature (Chung, 2015).

This study did not produce evidence to validate the absence of opportunity for students of color. What was evident was the variance in the performance of African American and White student groups that attended School II. Both these groups attended School II, had the same classes with the same teachers, yet varied in their academic performance. This is in juxtaposition with the BWTSG phenomena nationwide, in that a variance of performance exists between African American students and their white peers who share a similar SES.

RQ 2. *What are the differences in the Algebra II test scores of African American students and White students?*

While RQ1 focused on the difference between schools based on the impact of the school's SES, this question's comparisons were focused on race. The difficulty was in isolating

student performance in relation to the student's race apart from considering his or her SES or school affiliation. Thus, RQ2 was answered using a pairwise comparison of African American and White students across each school, as well as between each group at each school.

The analysis of School I White student's Algebra II scores confirmed no significant difference when compared to School I African American or School II White student scores. School I African American student scores were not significantly different when compared to School I or School II White student scores. School II White students scored similarly to both student groups at School I when compared. School II African Americans, however, scored significantly lower than all other groups, whereas African Americans at School I scored higher than all other groups.

The teacher questionnaire revealed that School I not only had fewer teachers with less than six years of experience, but they also had more teachers with more than 15 years of experience. Such results imply that there is less teacher turnover and more stability among faculty at School I. Could more cohesion among faculty have developed a more pleasant and relaxed learning environment, or a more sought-after place of employment? This case study did not investigate unequal distribution; however, this researcher recommends that future studies in TUSD include what has been found by other researchers. Namely, the quality of teachers, equity in teacher salaries, school funding and staff allocation have been found to impact student performance results (Barton & Coley, 2010; Meier, 2004; Phillips et al., 1998).

RQ 3. *Is there an interaction between race and school that impacts test scores?*

There was a statistically significant interaction between the effects of race and school on scores. School I, being an affluent school with students from a higher SES, did not reveal a significant difference between its African American and White students. The literature supports

the idea of no performance variance among students of like SES, regardless of race (Huo, 2018). The results are also in line with what is known as the BWTSG, in that White students at School II scored almost the same as White students at School I but score significantly higher than African American students at School II. The interaction involves African American students and the impact of poverty on performance and is in line with the findings of Mitchell (2018). School II is low-income and 70% of the students are eligible for free and reduced lunch. This also supports the argument by Gonzales et al. (2004) that students on free and reduced lunch, as well as African Americans, perform lower than their peers do.

RQ 4. *What are the potential technological factors that influence disparities in the performance of students identified in this study?*

The factors that were observed in the teacher and administrator responses correlate with the themes that were discussed in the review of literature. For instance, Question 4 of the Teacher Questionnaire revealed that 43% of those responding to the questionnaire were in agreement that they were more motivated to teach after technology was introduced into their classrooms as a teaching tool. While several authors were reviewed that discussed different aspects of teacher motivation (intrinsic, extrinsic, and administrative), it was extrinsic motivation that seemed most applicable to this study. Bonk (2002) believed that extrinsic motivation was that wherein teachers believed that the quality of their courses was increased by the use of technology, resulting in an increased motivation upon the teacher to teach. More than half the administrators who were surveyed believed that their teachers were more motivated since technology entered their classrooms for teaching purposes. There were four School II administrators holding this belief whereas, there were two from School I. The results would support School I only having two because the level of engagement with their students did not

substantially increase when technology was introduced into the classrooms. This can be supported by Question 2 on the Teacher Questionnaire, where only four teachers at School I responded that they were more engaged with their students since academic year 2016 and eight responded in kind at School II. Teacher engagement and teacher motivation impact their tenure and the quality of their instruction (Miller et al., 2008; Timothy, 2009).

Limitations

Underrepresentation of African American students required the inclusion of multiple academic years to substantiate an adequate sample. This could be deemed by some to weaken the results. The inability to obtain a cohort from the administration may also weaken the overall substance of the study. District administrators stated that this data was available but failed to submit it to the researcher during the period of data collection.

Usefulness of the results of this study to instructional design in addressing deficient performance could be challenging. On one hand, there was, and is likely to continue to be, a limited African American student population in TUSD. On the other hand, the superior performance of the African American student population at School I is contrary to what is common to those mentioned in discussions regarding the BWTSG.

Contribution to the field of study of the BWTSG may be partially limited by the performance of African American students at School I. Although the BWTSG is based on average academic results for African American students, the factors and variables mentioned in the literature are not present at School I and the gap was not corroborated by the data (Barton & Coley, 2010; Jencks & Phillips, 2011).

Recommendations

One avenue for further study would be research into specific influences of affluence on African American students with efforts to replicate these influences in a low-income setting. It would be important in such a study to determine if affluent African American students' parents were college-educated and to compare their performance to low-income African American students whose parents were also college-educated. Thus, an additional study that examines the impact of college-educated parents on African American students is recommended.

This researcher also suggests that the present case study be repeated but have cohort data included, along with student absentee rates, access to technological accommodations (especially at School II), and technological accommodations of chronically absent students and teaching practices at School II. Interviews should also be included in the future study to determine how African American students prepare for tests and to learn how they felt while testing.

Contributions

This study extended research on the BWTSG and the data from School I in TUSD offered a different perspective. Special emphasis was given to the academic performance of affluent African Americans math students who matriculate at an affluent school. The results of this study could inspire African American students to enter STEM-related majors. Furthermore, the findings provide TUSD district administrators with a case in their jurisdiction where the BWTSG was not a factor.

Future Direction to Body of Knowledge

While conducting research for this case study, it became apparent that there is a shift in research emphasis in addressing the phenomenon of the BWTSG. Traditionally, there have been studies of performance on standardized tests (Phillips et al. in 1998) and relative strategies to

close the gap by addressing performance-based variables (Barton & Coley, 2010; Jencks & Phillips, 2011; Meier, 2004; No Child Left Behind Act, 2002). However, technology has become a tool being used in various ways, not only to improve assessing performance but also to address performance deficits (Liou & Rotheram-Fuller, 2019). The age of technology has allowed many theories that were once far-fetched to now become relevant possibilities in discovering new causal factors regarding performance variance. Degruy (2005) coined the term Post Traumatic Slave Syndrome and alleged that chattel slavery caused trauma to the African slave that went untreated and resulted in psychological and emotional injury to their descendants. Yehuda et al. (2013), in a study of the children and grandchildren of Holocaust victims, found that Post-Traumatic Stress Disorder was present in those descendants. She further found that an epigenetic marker exists in the stressor gene of descendants that was also found in their ancestors. Future research may explore epigenetics and transgenerational trauma to determine if the triggers of past trauma impact academic performance in African Americans.

Conclusion

In conclusion, due to the advancement of technology, there may be an answer to the BWTSG. There have been numerous studies conducted and strategies executed that were discussed in the literature review performed for this case study. The data analyzed and findings presented in this study revealed mixed results that were seen in a significant interaction of race and school. Researchers may not witness a reduction in the BWTSG without exploring new possibilities, such as epigenetics and transgenerational trauma.

APPENDIX A

INSTITUTIONAL REVIEW BOARD APPROVAL

UNT
EST. 1890

THE OFFICE OF RESEARCH AND INNOVATION
Research and Economic Development

April 17, 2019

PI: Tandra Tyler-Wood
Study Title: CAN THE USE OF LEARNING TECHNOLOGIES IN TUSD CLASSROOMS CONTRIBUTE TO IMPROVED ACADEMIC PERFORMANCE IN AFRICAN AMERICAN HIGH SCHOOL STUDENTS

RE: Human Subjects Application # IRB-18-682

Dear Dr. Tandra Tyler-Wood:

In accordance with 45 CFR Part 46 Section 46.104, your study titled "CAN THE USE OF LEARNING TECHNOLOGIES IN TUSD CLASSROOMS CONTRIBUTE TO IMPROVED ACADEMIC PERFORMANCE IN AFRICAN AMERICAN HIGH SCHOOL STUDENTS" has been determined to qualify for an exemption from further review by the UNT Institutional Review Board (IRB).

No changes may be made to your study's procedures or forms without prior written approval from the UNT IRB. Please contact The Office of Research Integrity and Compliance at 940-565-4643 if you wish to make any such changes. Any changes to your procedures or forms after 3 years will require completion of a new IRB application.

We wish you success with your study.

Sincerely,

Shelley Riggs

Shelley Riggs, Ph.D.
Professor
Chair, Institutional Review Board

SR:jm

APPENDIX B

RESEARCH PROPOSAL TO TUSD

TUSD RESEARCH PROPOSAL

Bennie W. Baker, ABD

University of North Texas

Title of research:

Can the use of learning technologies in TUSD classrooms contribute to improved academic performance in African American high school students?

Objectives:

This is a continuation of an existing project that is focused on the study of the impact of technology on reducing the Black White Test Score Gap. The overall objective of this study is: to explore the impact of learning technology upon African American high school students.

Research Questions

- What is the impact of chronic absenteeism on the performance of high school freshmen and seniors?
- Does chronic absenteeism challenge learning in a digital classroom setting?
- Does the presence of technology improve parental involvement?
- Does the use of technology in the classroom improve class participation?
- Has the presence of educational technology improved teacher/student relationships?
- Has self-efficacy improved in students?
- Has socioeconomic status impacted the use of technology?
- Has the ability to connect to the internet impacted academic performance?
- Have classroom distractions increased, decreased, or remained the same since the introduction of computer technology in the academic environment?
- Has the performance on assessments by African American students improved since the introduction of educational technology in the classroom?

Justification of Proposed Research Project:

This research builds upon previous research that I have completed and is an investigation into the hypothesis that technology used properly and in conjunction with empirical strategies may improve the academic performance of African American students and set forth a trajectory that could completely bridge the Black White Test Score Gap (BWTSG). There are many factors that contribute to the academic variance that defines the BWTSG, however in the study I believe two will be evaluated; namely self-efficacy and absenteeism/chronic absenteeism.

Du et al. (2004) indicate that technology does have an impact on performance. There is historical data and previous research available that provides theoretical attempts to clarify and/or explain why there is variance along racial lines in the U.S. education system? The question does not linger over if there is variance, nor does it discuss at length where the variance lies; the question revolves around why there is variance and what could be done about it. Of all the authors reviewed one thing was consistent, namely, that there is variance in the performance results of African American and White students in the United States. Many causes are alleged; many are investigated, studied, and researched. What I found most compelling among all authors and works reviewed was absenteeism and chronic absenteeism.

Chronic absenteeism is explored as a factor in the variance between African American and White students by many authors. Nonetheless, Balfanz (2012) discusses chronic absenteeism by examining data provided from sources across the nation. Some examples: Finck (2016) reveals results of research conducted in the Houston school district regarding the impact of absenteeism to the students as well as the district.

Although research exists covering various aspects of learning and technology, I was not able to find much addressing whether growing use of technology in the classroom has reduced

the impact of absenteeism on the performance of students. In fact, Fuchs and Woessmann (2005) found that the bivariate evidence resulting from studies evaluating the relationship of the educational achievement between students and computer was deceptive.

Self-efficacy may impact a student's desire and/or confidence in an electronic learning environment. Quoting Bandura (1997), Majer (2009) states that "Self-efficacy is a cognitive resource that involves an individual's confidence or belief in one's ability to effectively engage in behaviors toward desired goals" (p. 243). Pajares (1994) states,

> Because peers serve as a major influence in the development and validation of self-efficacy, disrupted or impoverished peer relationships can adversely affect the growth of personal efficacy. A low sense of social efficacy can, in turn, create internal obstacles to favorable peer relationships. Thus, children who regard themselves as socially inefficacious withdraw socially, perceive low acceptance by their peers and have a low sense of self-worth. (p. 11)

Thus, in a learning environment, due to the impact that motivation and confidence has on one's focus, a student's self-efficacy plays a critical role in his or her ability to grasp concepts.

References

Balfanz, R., & Chang, H. (2013). A Focus on Attendance is Key to Success. *National Association of School Administrators*, 2015-1. Retrieved from http://www.nassp.org/tabid/3788/default.aspx?topic=A_Focus_on_Attendance_Is_Key_to_Success

Barton, P. E. & Coley, R. J. (2010) The black-white achievement gap: When progress stopped. Policy information report. *Educational Testing Service.*

Du, J., Havard, B., Yu, C., & Adams, J. (2004). The impact of technology use on low-income and minority students' academic achievement: educational longitudinal study of 2002. *Online Submission*, *4*(2), 21-38.g

Farkas, G. (2004). The black-white test score gap. *Contexts*, 3 (2), 12-19. Retrieved from: https://journals.sagepub.com/doi/abs/10.1525/ctx.2004.3.2.12

Finck, J. (2015). When students miss school: The high cost to Houston. *Retrieved from*. https://s3.amazonaws.com/bushhoustonliteracy-webassets/When-Students-Miss-School-Final-1.pdf

Giorgi, A.P. & Giorgi, B.M. (2003). The descriptive phenomenological psychological method. In Camic, P.M., Rhodes, J.E. & Yardley, L. (Eds.), *Qualitative research in psychology: Expanding perspectives in methodology and design* (Limited ed. and rev. ed., pp. 243-273). Washington, DC: American Psychological Association.

Graff, G. (2014). The intergenerational trauma of slavery and its aftermath. *Journal of Psychohistory*, *41*(3), 181-197.

Halloran, M. J. (2019). African American health and posttraumatic slave syndrome: A terror management theory account. *Journal of Black Studies*, *50*(1), 45-65. https://doi.org/10.1177/0021934718803737

Hammond, P. V., & Davis, B. L. (2007). *Post traumatic slave syndrome* [Review of the book *Post traumatic slave syndrome*, by J. DeGruy]. *ABNF* [Association of Black Nursing Faculty] *Journal*, *18*(4), 112.

Hannum, W. H. (2007). When computers teach: A review of the instructional effectiveness of computers. *Educational Technology*, *47*(2), 5-13. Retrieved from http://www.jstor.org/stable/44429482

Hedges, L. V., & Nowell, A., (2011). Black-white test score convergence since 1965. In C. Jencks & M. Phillips (Eds.), *The black-white test score gap* (pp. 149-181). Washington, DC: Brookings Institution Press.

Herrnstein, R. J., & Murray, C. (2010). *The bell curve: Intelligence and class structure in American life.* Simon and Schuster: New York, NY.

Hodgkinson, H. L. (1985). *All one system: Demographics of education, kindergarten through graduate school* [Report]. Washington, DC: Institute for Educational Leadership. Retrieved from https://files.eric.ed.gov/fulltext/ED261101.pdf

Hopson, M. H., Simms, R. L., & Knezek, G. A. (2001). Using a technology-enriched environment to improve higher-order thinking skills. *Journal of Research on Technology in Education*, *34*(2), 109-119.

Iro-Idoro, C. B., Ayodele, K. O., & Okuwoga, B. (2013). Technology use and self-efficacy as predictors of academic standing among polytechnic students in Ogun State. *International Journal of Social Sciences and Entrepreneurship, 1*(7), 131-139.

Jencks, C., & Phillips, M. (1998, spring). The black-white test score gap: Why it persists and what can be done. *The Brookings Review*, *16*(2), 24-27. doi:10.2307/20080778

Jencks, C., & Phillips, M. (2011). The black-white test score gap: An introduction. In C. Jencks & M. Phillips (Eds.), *The black-white test score gap* (pp. 1-54). Washington, DC: Brookings Institution Press.

Kellermann, N. P. F. (2013). Epigenetic transmission of holocaust trauma: Can nightmares be inherited? *The Israel Journal of Psychiatry and Related Sciences, 50*(1), 33-39.

Kellermann, N. P. F. (2015). *Epigenetic transgenerational transmission of Holocaust trauma: A Review* [Unpublished paper]. Retrieved from https://www.researchgate.net/publication/284350803_Epigenetic_transgenerational_transmission_of_Holocaust_trauma_A_Review/citation/download

Kennedy, G., Chang, R., Churchward, A., Gray, K., Judd, T., Waycott, J., . . .Bishop, A. (2007). The Net Generation are not big users of Web 2.0 technologies: Preliminary findings. In R. Atkinson, A. S. S. Kit, C. McBeath, & C. Cheers (Eds.), *Proceedings of ASCILITE - Australian Society for Computers in Learning in Tertiary Education Annual Conference 2007* (pp. 517-525). Tugun, Australia: Australasian Society for Computers in Learning in Tertiary Education. Retrieved from https://www.learntechlib.org/p/46105/

Kim, J. S., & Sunderman, G. L. (2005). Measuring academic proficiency under the No Child Left Behind Act: Implications for educational equity. *Educational Researcher*, *34*(8), 3-13.

Kuo, Y.-C., & Belland, B. R. (2019). Exploring the relationship between African American adult learners' computer, Internet, and academic self-efficacy, and attitude variables in technology-supported environments. *Journal of Computing in Higher Education*, 1-17. https://doi.org/10.1007/s12528-019-09212-3

Lee, J. (2001). Instructional support for distance education and faculty motivation, commitment, satisfaction. *British Journal of Educational Technology*, *32*(2), 153-160. https://doi.org/10.1111/1467-8535.00186

Liou, D. D., & Rotheram-Fuller, E. (2019). Where is the real reform? African American students and their school's expectations for academic performance. *Urban Education*, *54*(3), 397-429. https://doi.org/10.1177%2F0042085915623340

Maddrell, J. (2014). Service-learning instructional design considerations. *Journal of Computing in Higher Education*, *26*(3), 213-226.

Maguire, L. L. (2005). Literature review–Faculty participation in online distance education: Barriers and motivators. *Online Journal of Distance Learning Administration*, *8*(1), 1-16.

Majer, J. M. (2009). Self-efficacy and academic success among ethnically diverse first-generation community college students. *Journal of Diversity in Higher Education*, *2*(4), 243-250.

Pajares, F., & Miller, M. D. (1994). Role of self-efficacy and self-concept beliefs in mathematical problem solving: A path analysis. *Journal of educational psychology*, *86*(2), 193.

Woessmann, L., & Fuchs, T. (2004). Computers and student learning: Bivariate and multivariate evidence on the availability and use of computers at home and at school. Munich, Germany: Ifo Institute for Economic Research at the University of Munich Poschingerstr.

Sample Group & Specific Criteria:

This project gathers academic performance data from two freshmen classes at two different schools, and two senior classes from the same schools.

- The classes will be either math, reading/Language Arts or Science.
- The same class must be used for Seniors in both schools.
- The schools will be School I and School II.
- The Freshmen classes must use the same classes as well.
- Progress reports will be evaluated, report cards, and major assessments.
- Throughout the study some students, faculty, and family members may be asked to complete surveys.

Sample Group:

The groups will be the students in the selected classes. The students will not be named in any portion of this experiment. Only demographic, geographic and possibly socioeconomic data will be included in the reports generated from this research. Consent forms will be issued to every student as well as

Sample Group Involvement:

Visits will be made by the project leader to a sub-set of the sample in their settings. Once again participation by the practitioners will be through self-selection. A multi- method approach will include the use of semi-structured interview; observation; collection of data via digital computerized images and examination of documentation (surveys/questionnaires) completed by the participants.

Consent:

A group meeting of all adult participants will take place prior to commencement of the project. All participants will be given a copy of the British Educational Research Association (BERA) (2004) Revised Ethical Guidelines for Educational Research (Appendix 1). These guidelines will be read at the meeting and fully discussed as to their ramifications for the research project in the particular early year's settings. Agreements made by all at the meeting, where all parties have reached 'an ethically acceptable position in which their actions would be considered justifiable and sound', (BERA, 2004), will form the basis of a research consent form which will be signed by participant and researcher.

Potential Risks and Mitigations:

No personal identifiable information of any participant will be used. The risk of harm has been removed by ensuring only anonymous data will be used.

Ownership of material completed by the children

The original materials will remain with TUSD.

Anonymity and Confidentiality of the subjects:

All participants will be assured that their names and their setting will not be divulged. In written documentation, when and if names are necessary for research purposes, the children's first names will be changed, and surnames will not be used.

APPENDIX C

SCHOOL DISTRICT APPROVAL

TUSD

DEPARTMENT OF ASSESSMENT AND EVALUATION

102 N. Plumer • Tucson, Arizona 85719
(520)225.3225 • fax (520)225.3214

December 14, 2018

Rev. Bennie W. Baker
2800 E. 36th Street
Tucson, AZ 85713-4277

Project Title: **Can the Use of Learning Technologies in TUSD Classrooms Contribute to Improved Academic Performance in African American High School Students**

Dear Rev. Baker,

On behalf of the Tucson Unified School District, I am pleased to inform you that your request to conduct research has been approved for the **2018- 2019** school year. We are committed to collaborating with you on your study. In support of your research, we agree to provide you with the opportunity to recruit high school students from Sabino and Palo Verde to participate in your study of the use of learning technologies.

As a provision of approval, we require that you:

1) Provide the principals with an overview of the study and ask him/her to sign a copy of the attached consent form. Signed Principal approval forms need to be in your file so please mail the forms to me.

2) Obtain signed parental/guardian consent for each student and keep the consent forms in a secure location.

3) Provide a report to district administration upon the completion of your study.

4) Re-apply annually if your study is a multi-year project.

We look forward to working with you to facilitate this study. Please call me if you have any questions.

Sincerely,

APPENDIX D

AUTHORIZATION FROM SCHOOLS

TUSD

2018-2019 School Year

PRINCIPAL OR DEPARTMENT HEAD PERMISSION FORM

Request To Conduct Research In a TUSD School
or Department During the **2018-2019** School Year

All researchers must have their projects officially approved by the External Research Review Committee before approaching you for consent. When approved, researchers are sent a letter indicating that their project has been officially approved. Researchers need to provide you with a copy of this for your records. Please indicate whether you approve or disapprove of this study being conducted in your school or department and return this form to Curriculum and Instruction – Assessment and Program Evaluation.

Please note that this researcher has permission to contact you for the current school year only. The researcher must re-apply annually to conduct multi-year projects. If you have questions, contact Dynah Oviedo at 225-3225.

Bennie W. Baker _____ is
Researcher's Name

☒ **GRANTED** ☐ **NOT GRANTED** permission to conduct a study entitled:

Can the use of learning technologies in TUSD classrooms contribute to improved academic performance in African American high school students?
Name of Study

in Palo Verde Magnet High School
School or Department Name

Principal or Department Head Signature	Date	Project #
	1/6/19	

TUSD

2018-2019 School Year

PRINCIPAL OR DEPARTMENT HEAD PERMISSION FORM

Request To Conduct Research In a TUSD School or Department During the 2018-2019 School Year

All researchers must have their projects officially approved by the External Research Review Committee before approaching you for consent. When approved, researchers are sent a letter indicating that their project has been officially approved. Researchers need to provide you with a copy of this for your records. Please indicate whether you approve or disapprove of this study being conducted in your school or department and return this form to Curriculum and Instruction – Assessment and Program Evaluation.

Please note that this researcher has permission to contact you for the current school year only. The researcher must re-apply annually to conduct multi-year projects. If you have questions, contact Dynah Oviedo at 225-3225.

Bennie W. Baker is
Researcher's Name

☒ **GRANTED** ☐ **NOT GRANTED** permission to conduct a study entitled:

Can the use of learning technologies in TUSD classrooms contribute to improved academic performance in African American high school students?
Name of Study

in Sabino High School
School or Department Name

Principal or Department Head Signature

12/18/18
Date

Project #

REFERENCES

Alexander, K. L., Entwisle, D. R., & Olson, L. S. (2007). Summer learning and its implications: Insights from the Beginning School Study. *New Directions for Youth Development, 2007*(114), 11-32.

Allen, I. E., & Seaman, J. (2011). *Going the distance: Online education in the United States, 2011* [Report]. Newburyport, MA: Sloan Consortium.

Anderson, J. D. (2004). The historical context for understanding the test score gap. *Journal of Public Management & Social Policy, (10)*1, 2-22.

Arizona Population. (2020). Retrieved 2020-04-26, from http://worldpopulationreview.com/states/arizona/

Bank, C. T. D. (2010). *Children in poverty*. Retrieved from http://www.rikidscount.org/Portals/0/Uploads/Documents/Factbook%202015/Economic%20Well-Being/Ind13-ChildreninPoverty-2015.pdf

Barton, P. E., & Coley, R. J. (2010). *The black-white achievement gap: When progress stopped* [Policy information report]. Princeton, NJ: Educational Testing Service.

Betts, D. S. (1998, fall). An institutional overview: Factors influencing faculty participation in distance education in postsecondary education in the United States: An institutional study. *Online Journal of Distance Learning Administration, 1*(3). Retrieved from https://www.westga.edu/~distance//betts13.html

Blackburn, R. T., & Lawrence, J. H. (1995). *Faculty at work: Motivation, expectation, satisfaction*. Baltimore, MD: Johns Hopkins University Press.

Blum, R. W. (2005). A case for school connectedness. *Educational Leadership, 62*(7). 16-20.

Bonk, C. J. (2002). *Online teaching in an online world* [Paper]. Retrieved from http://www.publicationshare.com/docs/corp_survey.pdf

Buckingham, D. (2013). *Media education: Literacy, learning and contemporary culture*. Cambridge, United Kingdom: Polity Press.

Burdick-Will, J., Ludwig, J., Raudenbush, S. W., Sampson, R. J., Sanbonmatsu, L., & Sharkey, P. (2011). Converging evidence for neighborhood effects on children's test scores: An experimental, quasi-experimental, and observational comparison. In G. Duncan & R. Murnane (Eds.), *Whither Opportunity? Rising Inequality, Schools, and Children's Life Chances* (pp. 255-276.)

Campbell, J. R., Hombo, C. M., & Mazzeo, J. (2000). *NAEP 1999 trends in academic progress: Three decades of student performance* (NCES 2000-469). Washington, DC: National Center for Education Statistics, Office of Educational Research and Improvement, U.S. Department of Education.

Card, D., & Rothstein, J. (2006). *Racial segregation and the Black-White test score gap* (NBER Working Paper 12078). Cambridge, MA: National Bureau of Economic Research. Retrieved from https://www.nber.org/papers/w12078.pdf

Center, K. C. D., & Council, A. (2005). *2014 Kids count data book*. Baltimore, MD: The Annie E. Casey Foundation.

Chang, I., & Hsu, C. (2009). Research on the path of the influence of principals' technology leadership on teachers' information technology literacy in metropolitan elementary schools. *Journal of Elementary Education*, *33*, 1-32.

Craig, W. J., & Scott, T. (2019). K–12 achievement gap is a national problem. *Center for Urban and Regional Affairs, University of Minnesota, 48(1).* 23-28.

Creswell, J. (2013). *Qualitative inquiry & research design: Choosing among five approaches* (3rd ed.). Thousand Oaks, CA: Sage.

Creswell, J. W., & Creswell, J. D. (2017). *Research design: Qualitative, quantitative, and mixed methods approaches* (3rd ed.). Thousand Oaks, CA: Sage.

Darling-Hammond, L. (1998). Teachers and teaching: Testing policy hypotheses from a national commission report. *Educational researcher*, *27*(1), 5-15.

Darling-Hammond, L., Bae, S., Cook-Harvey, C. M., Lam, L., Mercer, C., Podolsky, A., & Stosich, E. L. (2016). *Pathways to new accountability through the Every Student Succeeds Act* [Report]. Palo Alto, CA: Learning Policy Institute. Retrieved from http://learningpolicyinstitute.org/our-work/publications-resources/pathways-new-accountability-every-student-succeeds-act

Darling-Hammond, L., Zielezinski, M. B., & Goldman, S. (2014). *Using technology to support at-risk students' learning*. Washington, DC: Alliance for Excellent Education.

Davies, R. S., & West, R. E. (2014). Technology integration in schools. In J. M. Spector, M. D. Merrill, J. Elen, & M. J. Bishop (Eds.), *Handbook of research on educational communications and technology* (4th ed., pp. 841-854). New York, NY: Springer.

DeGruy, J. (2005). *Post traumatic slave syndrome*. Portland, OR: Joy DeGruy RSS.

Dillon, C. L., & Walsh, S. M. (1992). Faculty: The neglected resource in distance education. *American Journal of Distance Education*, *6*(3), 5-21.

Du, J., Havard, B., Sansing, W., & Yu, C. (2004). The impact of technology use on low-income and minority students' academic achievements: Educational longitudinal study of 2002. In *Proceedings of the 27th Association for Educational Communications and Technology*

Annual conference (pp. 274-278). Bloomington, IN: Association for Educational Communication and Technology.

Duncan, G. J., Kalil, A., & Ziol-Guest, K. M. (2013). Early childhood poverty and adult achievement, employment and health. *Family Matters*, *93*, 27-35.

Estrada, M., Burnett, M., Campbell, A. G., Campbell, P. B., Denetclaw, W. F., Gutiérrez, C. G., ... & Okpodu, C. M. (2016). Improving underrepresented minority student persistence in STEM. *CBE—Life Sciences Education*, *15*(3), es5.

Every Student Succeeds Act of 1995, Pub. L. No. 114-95, S. 1177, 114th Cong. (1995). Retrieved from https://www.ed.gov/essa

Farkas, G. (2004). The black-white test score gap. *Contexts*, *3*(2), 12-19. https://doi.org/10.1525/ctx.2004.3.2.12

Ferreira, M. M., & Patterson, C. M. (2011). Improving equity through a science enrichment program. *Advancing Women in Leadership*, *31*, 119-124. Retrieved from http://advancingwomen.com/awl/Vol31_2011/Ferreirafinal147_30.pdf

Fuchs, T., & Woessmann, L. (2005). *Computers and student learning: Bivariate and multivariate evidence on the availability and use of computers at home and at school* (Ifo [Institute for Economic Research at University of Munich] Working Paper No. 8). Retrieved from https://www.ifo.de/DocDL/IfoWorkingPaper-8.pdf

Garcia, E., & Weiss, E. (2018). *Student absenteeism: Who misses school and how missing school matters for performance* [Report]. Washington, DC: Economic Policy Institute.

Geverdt, D. (2019). *Education Demographic and Geographic Estimates program (EDGE): School Neighborhood poverty estimates*, 2016-2017 (NCES 2019-112). Washington, DC:

National Center for Education Statistics, U.S. Department of Education. Retrieved from http://nces.ed.gov/pubsearch/

Gonzales, P., Guzmán, J. C., Partelow, L., Pahlke, E., Jocelyn, L., Kastberg, D., & Williams, T. (2004). *Highlights from the Trends in International Mathematics and Science Study (TIMSS) 2003* (NCES 2005-005). Washington, DC: U.S. Government Printing Office.

Gravemeijer, K., Stephan, M., Julie, C., Lin, F. L., & Ohtani, M. (2017). What mathematics education may prepare students for the society of the future? *International Journal of Science and Mathematics Education*, *15*(1), 105-123.

Hannum, W. H. (2007). When computers teach: A review of the instructional effectiveness of computers. *Educational Technology*, *47*(2), 5-13. Retrieved from http://www.jstor.org/stable/44429482

Hodgkinson, H. L. (1985). *All one system: Demographics of education, kindergarten through graduate school* [Report]. Washington, DC: Institute for Educational Leadership. Retrieved from https://files.eric.ed.gov/fulltext/ED261101.pdf

Hopson, M. H., Simms, R. L., & Knezek, G. A. (2001). Using a technology-enriched environment to improve higher-order thinking skills. *Journal of Research on Technology in Education*, *34*(2), 109-119.

Huettl, K. J., (2016). *The relationship between poverty and student achievement* (Paper, Culminating Projects in Teacher Development). Retrieved from https://repository.stcloudstate.edu/ed_etds/16

Hutchinson, B., & Mitchell, M. (2019). 50 years of test (un)fairness: Lessons for machine learning. In *Proceedings of the Conference on Fairness, Accountability, and Transparency* (pp. 49-58). New York, NY: Association for Computing Machinery.

Iro-Idoro, C. B., Ayodele, K. O., & Okuwoga, B. (2013). Technology use and self-efficacy as predictors of academic standing among polytechnic students in Ogun State. *International Journal of Social Sciences and Entrepreneurship, 1*(7), 131-139.

Jacob, B. A., & Lovett, K (2017). *Chronic absenteeism: An old problem in search of new answers* [Report]. Washington, DC: Brookings Institution.

Jencks, C., & Phillips, M. (1998, spring). The black-white test score gap: Why it persists and what can be done. *The Brookings Review*, *16*(2), 24-27. doi:10.2307/20080778

Jencks, C., & Phillips, M. (2011). The black-white test score gap: An introduction. In C. Jencks & M. Phillips (Eds.), *The black-white test score gap* (pp. 1-54). Washington, DC: Brookings Institution Press.

Kelly, 2009

Kennedy, G., Chang, R., Churchward, A., Gray, K., Judd, T., Waycott, J., . . . Bishop, A. (2007). The Net Generation are not big users of Web 2.0 technologies: Preliminary findings. In R. Atkinson, A. S. S. Kit, C. McBeath, & C. Cheers (Eds.), *Proceedings of ASCILITE - Australian Society for Computers in Learning in Tertiary Education Annual Conference 2007* (pp. 517-525). Tugun, Australia: Australasian Society for Computers in Learning in Tertiary Education. Retrieved from https://www.learntechlib.org/p/46105/

Kim, J. S., & Sunderman, G. L. (2005). Measuring academic proficiency under the No Child Left Behind Act: Implications for educational equity. *Educational Researcher*, *34*(8), 3-13.

Kornrich, S., & Furstenberg, F. (2013). Investing in children: Changes in parental spending on children, 1972-2007. *Demography*, *50*, 1-23.

Kuo, Y.-C., & Belland, B. R. (2019). Exploring the relationship between African American adult learners' computer, Internet, and academic self-efficacy, and attitude variables in technology-supported environments. *Journal of Computing in Higher Education*, 1-17. https://doi.org/10.1007/s12528-019-09212-3

Langevin, M. J. (2015). *AdvancED accreditation impact regarding the achievement gap between schools of poverty and schools of affluence for secondary education in a five-state region* (Doctoral dissertation). Indiana State University, Terre Haute, Indiana.

Lee, J. (2001). Instructional support for distance education and faculty motivation, commitment, satisfaction. *British Journal of Educational Technology*, *32*(2), 153-160. https://doi.org/10.1111/1467-8535.00186

Lehrner, A., & Yehuda, R. (2018). Cultural trauma and epigenetic inheritance. *Development and Psychopathology*, *30*(5), 1-15. doi:10.1017/S0954579418001153

Lewis, E. L., & Hunt, B. (2019). High expectations: Increasing outcomes for black students in urban schools. *Urban Education Research & Policy Annuals*, *6*(2), 77-89.

Li, X., Atkins, M. S., & Stanton, B. (2006). Effects of home and school computer use on school readiness and cognitive development among Head Start children: A randomized controlled pilot trial. *Merrill-Palmer Quarterly/Journal of Developmental Psychology*, *52*(2), 239-263.

Liou, D. D., & Rotheram-Fuller, E. (2019). Where is the real reform? African American students and their school's expectations for academic performance. *Urban Education*, *54*(3), 397-429. https://doi.org/10.1177%2F0042085915623340

Machado, L. J., & Chung, C. J. (2015). Integrating Technology: The Principals' Role and Effect. *International Education Studies*, *8*(5), 43-53.

Maddrell, J. (2014). Service-learning instructional design considerations. *Journal of Computing in Higher Education*, *26*(3), 213-226.

Maguire, L. L. (2005). Literature review–Faculty participation in online distance education: Barriers and motivators. *Online Journal of Distance Learning Administration*, *8*(1), 1-16.

Majer, J. M. (2009). Self-efficacy and academic success among ethnically diverse first-generation community college students. *Journal of Diversity in Higher Education*, *2*(4), 243-250. doi:10.1037/a0017852

Martin, D. B. (2000). *Mathematics success and failure among African-American youth: The roles of sociohistorical context community forces, school influence, and individual agency*. New York, NY: Routledge.

McClure, P. (2008). The history of educational comparability in Title I of the Elementary and Secondary Education Act of 1965 [Paper]. In *Ensuring equal opportunity in public education: How local school district funding practices hurt disadvantaged students and what federal policy can do about it* (pp. 9-32). Retrieved from https://cdn.americanprogress.org/wpcontent/uploads/issues/2008/06/pdf/comparability.pdf

Meier, D. (2004). NCLB's selective vision of equality: Some gaps count more than others. In D. Meier & G. Wood, (Eds.), *Many children left behind: How the No Child Left Behind Act is damaging our children and our schools* (pp. 53-65). Boston, MA: Beacon Press.

Milner, H. R., & Hoy, A. W. (2003). A case study of an African American teacher's self-efficacy, stereotype threat, and persistence. *Teaching and Teacher Education*, *19*(2), 263-276.

Mitchell, M. (2018). *Program evaluation for assessing the effectiveness of tracking the academic growth and attendance of black students in closing the black and white achievement gap* (Dissertation). Retrieved from https://digitalcommons.nl.edu/diss/309

Monaghan, E. J. (2005). *Learning to read and write in colonial America*. Worcester, MA: University of Massachusetts Press.

Monroe-Lax, D., & Ko, J. Y. (2017). Economic determinant analysis of student academic performance in Mississippi public schools. *Journal of Public Management & Social Policy*, *24*(1), 4.

National Center for Education Statistics. (2007). *Status and trends in the education of racial and ethnic minorities*. Retrieved from http://nces.ed.gov/pubs2007/minoritytrends/

National Forum on Education Statistics. (2015). *Forum guide to alternative measures of socioeconomic status in education data systems* (NFES 2015-158) [Report]. Washington, DC: National Center for Education Statistics, U.S. Department of Education. Retrieved from https://nces.ed.gov/pubs2015/2015158.pdf

Ni, H. W., Goodale, B. M., & Huo, Y. J. (2019). How the rich get richer: affluence cues at universities increase the social class achievement gap. *Social Psychology of Education*, 1-17.

No Child Left Behind Act of 2001. Pub. L. No. 107–110, 115 S. 1425, 109th Cong. (2002). Retrieved from https://www2.ed.gov/nclb/landing.jhtml

Oakes, J., Ormseth, T., Bell, R., & Camp, P. (1990). *Multiplying inequalities: The effects of race, social class, and tracking on opportunities to learn mathematics and science* [Report]. Santa Monica, CA: RAND Corp.

Olcott, D., Jr., & Wright, S. J. (1995). An institutional support framework for increasing faculty participation in postsecondary distance education. *American Journal of Distance Education*, *9*(3), 5-17.

Owens, A. (2016). The consequences of income segregation between school districts for economic and racial achievement gaps.

Phillips, M., Crouse, J., & Ralph, J. (1998). Does the black-white test score gap widen after children enter school? In C. Jencks & M. Phillips (Eds.), *The Black-White test score gap*. Washington, DC: Brookings Institution.

Protheroe, N. (2001). Improving teaching and learning with data-based decisions: Asking the right questions and acting on the answers. *ERs spectrum*, *19*(3), 4-9.

Quinn, D. M. (2015). Kindergarten Black-White test score gaps: Re-examining the roles of socioeconomic status and school quality with new data. *Sociology of Education*, *88*(2), 120-139. https://doi.org/10.1177/0038040715573027

Ready, D. D. (2010). Socioeconomic disadvantage, school attendance, and early cognitive development: The differential effects of school exposure. *Sociology of Education*, *83*(4), 271-286. https://doi.org/10.1177%2F0038040710383520

Reardon, S. F. (2016). School segregation and racial academic achievement gaps. *RSF: The Russell Sage Foundation Journal of the Social Sciences*, *2*(5), 34-57.

Reardon, S. F. (2013). The widening income achievement gap. *Educational Leadership*, *70*(8), 10-16.

Reardon, S. F., Kalogrides, D., & Shores, K. (2019). The geography of racial/ethnic test score gaps. A*merican Journal of Sociology*, *124*(4), 1164-1221.

Riegle-Crumb, C., & King, B. (2010). Questioning a white male advantage in STEM: Examining disparities in college major by gender and race/ethnicity. *Educational Researcher, 39*(9), 656-664.

Rippeyoung, P. L. F. (2009). Is it too late baby? Pinpointing the emergence of a black-white test score gap in infancy. *Sociological Perspectives, 52*(2), 235-258. https://doi.org/10.1525%2Fsop.2009.52.2.235

Rockwell, S. K., Schauer, J., Fritz, S. M., & Marx, D. B. (1999). Incentives and obstacles influencing higher education faculty and administrators to teach via distance. *Online Journal of Distance Learning Administration, 2*(4). Retrieved from http://digitalcommons.unl.edu/aglecfacpub/53

Rodriguez, A., & McGuire, K. M. (2019). More classes, more access? Understanding the effects of course offerings on Black-White gaps in Advanced Placement course-taking. *The Review of Higher Education, 42*(2), 641-679.

Rothstein, J., & Wozny, N. (2013). Permanent income and the black-white test score gap. *Journal of Human Resources, 48*(3), 510-544.

Sablich, L. (2016). *7 Findings that illustrate racial disparities in education* (Brookings Brown Center Chalkboard) [Blog post]. Retrieved from https://www.brookings.edu/blog/brown-center-chalkboard/2016/06/06/7-findings-that-illustrate-racial-disparities-in-education/

Schifter, C. C. (2000). Faculty motivators and inhibitors for participation in distance education. *Education Technology, 40*(2), 43-46.

Schindler, P. S., & Cooper, D. R. (2006). *Business research methods* (9th ed.). New York, NY: McGraw-Hill.

Schulze, S., & van Heeren, M. (2015). Learning environments matter: Identifying influences on the motivation to learn science. *South African Journal of Education*, *35*(2), 1058.

Shu, Q., Tu, Q., & Wang, K. (2011). The impact of computer self-efficacy and technology dependence on computer-related technostress: A social cognitive theory perspective. *International Journal of Human-Computer Interaction*, *27*(10), 923-939. https://doi.org/10.1080/10447318.2011.555313

Smith, P. S., Nelson, M. M., Trygstad, P. J., & Banilower, E. R. (2013). *Unequal distribution of resources for K-12 science instruction: Data from the 2012 National Survey of Science and Mathematics Education* [Paper]. Chapel Hill, NC: Horizon Research. Retrieved from https://files.eric.ed.gov/fulltext/ED548250.pdf

Smith, P. S., Trygstad, P. J., & Banilower, E. R. (2016). Widening the gap: Unequal distribution of resources for K-12 science instruction. *Education Policy Analysis Archives, 24,* 8.

Steup, M. (2018, winter). Epistemology. In E. N. Zalta (Ed.), *The Stanford Encyclopedia of Philosophy* [Online]. Retrieved from https://plato.stanford.edu/archives/win2018/entries/epistemology/

Thum, Y. M., & Hauser, C. H. (2015). *NWEA 2015: MAP norms for student and school achievement status and growth* [Report]. Portland, OR: Northwest Evaluation Association.

Timothy, T. E. O. (2009). Examining the relationship between student teacher' self-efficacy beliefs and their intended uses of technology for teaching: A structural equation modelling approach. *TOJET: The Turkish Online Journal of Educational Technology*, *8*(4), 7-15.

U.S. Census Bureau. (2015). *Public education finances: 2013* (G13-ASPEF). Washington, DC: U.S. Government Printing Office.

U.S. Census Bureau. (2018). *Quick facts: Tucson city Arizona*. Retrieved from https://www.census.gov/quickfacts/geo/chart/tucsoncityarizona/EDU635217

U.S. Department of Education. (2019). *Federal TRIO program current-year low-income levels.* Retrieved from https://www2.ed.gov/about/offices/list/ope/trio/incomelevels.html

Vigdor, J., & Ludwig, J. (2007). *Segregation and the black-white test score gap* (NBER Working Paper No. 12988). Cambridge, MA: National Bureau of Economic Research.

von Hippel, P. T., & Hamrock, C. (2019). Do test score gaps grow before, during, or between the school years? Measurement artifacts and what we can know in spite of them. *Sociological Science*, *6*, 43-80.

Winkleby, M. A., Jatulis, D. E., Frank, E., & Fortmann, S. P. (1992). Socioeconomic status and health: how education, income, and occupation contribute to risk factors for cardiovascular disease. *American journal of public health*, *82*(6), 816-820.

Wolf, P. J. (2005). School choice by mortgage or by design: Implications for the black-white test-score gap. In P. E. Peterson (Ed.), *Generational change: Closing the test score gap* (pp. 167-197). Lanham, MD: Rowman & Littlefield.

Yehuda, R., Daskalakis, N. P., Desarnaud, F., Makotkine, I., Lehrner, A., Koch, E., & Bierer, L. M. (2013). Epigenetic biomarkers as predictors and correlates of symptom improvement following psychotherapy in combat veterans with PTSD. *Frontiers in Psychiatry*, *4*, 1-14. https://doi.org/10.3389/fpsyt.2013.00118

Yin, R. K. (2014). Designing case studies. In *Case study research: Design and methods* (5th ed.). Thousand Oaks, CA: Sage.