Technology Access, Integration, And Student Achievement: Examining Diverse Technology Learning Environments And College And Career Readiness In Rural North Mississippi High Schools

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TECHNOLOGY ACCESS, INTEGRATION, AND STUDENT ACHIEVEMENT:
EXAMINING DIVERSE TECHNOLOGY LEARNING ENVIRONMENTS
AND COLLEGE AND CAREER READINESS IN RURAL NORTH
MISSISSIPPI HIGH SCHOOLS

A Dissertation
presented in partial fulfillment of requirements
for the degree of Doctor of Philosophy
in the Department of Leadership and Counselor Education
The University of Mississippi

by
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ABSTRACT

Teaching and learning practices influence college and career readiness (CCR) as measured by newly implemented Common Core State Standards (CCSS) through next-generation assessments. This mixed-methods study examined different levels of technology access and integration on current CCR measurements in two rural North Mississippi school districts. The approach incorporated a causal-comparative design and an exploration of attitudes and perceptions about technology’s impact on college and career readiness. The study found statistical significance in differences of ACT® mean scores for the composite, English, reading and science assessments between the two school districts. The district with a one to one laptop learning environment demonstrated higher scores over the district with a limited or shared technology access and integration. Although there were significant differences found, small effect sizes and confidence levels suggest a need to further investigate to substantiate practical significance (Morgan et al., 2013). There was no statistical significance in ACT® mean math scores between the two districts. Qualitative exploration confirmed the quantitative findings expounding on perceptions and attitudes toward technology access and integration, technology implications on college and career readiness, and implications on standardized testing. This study provided pertinent and relevant information in regards to technology’s impact on teaching and learning in preparing today’s students with the knowledge and skills to be successful beyond high school in an ever-changing technology driven society.
ACKNOWLEDGMENTS

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CHAPTER I

INTRODUCTION

The rapid rise of technology over the last two decades for personal and career use is integrating and mainstream in our 21st century society. Common Core State Standards (CCSS) adoption suggests the need to leverage technology in the learning experiences of our K-12 students to provide them not only with rigorous content knowledge and application capabilities, but also with skills necessary to be successful beyond high school. According to Darling-Hammond (2014), students today “. . . need to be able to find, evaluate, synthesize, and use knowledge in new contexts, frame and solve nonroutine problems, and produce research findings and solutions” (p. 1). With the changing experiences of life and work as well as the implementation of CCSS with next-generation assessments, educational structures are embracing technology as a necessary tool for teaching and learning. Technology will play an important role and impact performance abilities in high-stakes testing of content standards anchored in college and career readiness (CCR) foundations for school accountability measurements (Achieve, Inc., National Association of Secondary School Principals, & National Association of Elementary School Principals, 2012; Gullen, 2014).

The current educational environment has been defined by the federal legislation of No Child Left Behind (NCLB) in 2001. Unfortunately, NCLB did not address CCR concerns, and the evolving influences of our global-connected society have magnified these concerns as problematic in the present educational state. The NCLB era requires state content standards development and high-stakes testing for English language arts (ELA), math, and science to
evaluate student performance and provide school accountability measurements (U.S. Department of Education, 2003). Results of this legislation have had an overwhelming impact on teaching and learning practices. Implications of lowering state content standards (Peterson & Hess, 2008), school-wide focus on only tested areas, and teaching to the test (Britannica Editors, 2010; Center of Educational Policy, 2008; Dee & Jacob, 2011; Groen, 2012, Starr, 2012; Zaho, 2012) have surfaced as results of 10 years of the NCLB mandate. These implications have hindered opportunities to use technology’s full potential to enhance teaching and learning.

Technology access and integration in K-12 schools are vital to current and future teaching and learning practices. Past research demonstrates haphazard approaches to understanding technology’s impact on student achievement (Bebell, O’Dwyer, Russell, & Hoffmann, 2010). The intent of these research approaches is appropriate; however, the ambiguity in the research on technology and its influences on teaching and learning create varied and unreliable outcomes when tied to student achievement (Bebell et al., 2010; Holcomb, 2009; Spires, Oliver, & Corn, 2011). Researchers suggest concerns of variations in understanding the terminology differences in technology “access” and “integration,” whereas, “access” represents only when technology is available to students and “integration” describes how technology is used in teaching and learning (Bebell & O’Dwyer, 2010; Bebell, et al., 2010; Holcomb, 2009). Others pinpoint the levels of technology integration or the variations of how technology is used as significant concerns (Bebell & O’Dwyer, 2010; Bebell, et al., 2010; Dunleavy, Dexter, & Heinecke, 2007; Holcomb, 2009; Norris & Soloway, 2011; Norris, Hossain, & Soloway, 2011; Rosen & Beck-Hill, 2012; Spires et al., 2011). As schools adopt the CCSS and implement next-generation assessments, recognizing past technology trends and understanding the
inefficiencies in past research will help develop a need to study the relationship of technology in teaching and learning and impact the new era of college and career readiness demands for today’s students.

**Statement of the Problem**

The ACT®, originally identified as the American College Testing program (ACT, Inc. 2014b), has historically played a significant role in measuring student college readiness. Its commitment to research ensures a dynamic approach to current educational trends, therefore, providing a strong foundation and relationship for measuring college readiness through assessment programs. According to ACT, Inc. (2006b), evidence concerning comparability of college readiness and career readiness in reading and math was found in a study between the ACT achievement test and the WorkKeys job skills assessment. This evidence suggested that, “We should be educating all high school students according to a common academic expectation, one that prepares them for both postsecondary education and the workforce” (p. 1).

Review of current educational practices helped instigate a prompt to retitle the ACT College Standards to include Career and update verbiage alignment with CCSS (ACT, Inc. 2014a). ACT’s alignment with College and Career Readiness Standards and College Readiness benchmarks provides national assessment measurements in English, math, reading, science, and writing (ACT, Inc. 2014a). ACT continues to evolve as educational changes supporting school improvement ensue (ACT, Inc. 2014d). This continued commitment in the ACT assessment program helps provide formative data on the reality of today’s student readiness beyond high school.

According to ACT, Inc. (2014d), over 1.8 million graduates took the ACT in 2014. Although some research indicates concerns with the ACT composite as a valid predictor for
college success (Bettinger, Evans, & Pope, 2013), the use of the ACT composite and subscore benchmarks are currently used for college admission purposes. Higher education admission policies also incorporate other indicators to determine student acceptance at two-year and four-year colleges. These indicators include grade point average (GPA), class rank, and grades. Other indicator uses in the college admission process imply the use of one indicator only as not sufficient. However, the subjective perspectives of these indicators become problematic when measuring college and career readiness. For example, GPA is formulated by grades earned. Although higher education admission procedures include reviews of high school transcripts, course titles, and curriculum rigor will differ across districts, schools, and even classrooms. In classrooms across the country grades are earned daily by students. However, the influences of those grades can be biased based on teacher influences as well as curriculum implications. Class rank as an indicator can also be challenging considering rank is determined by academic strength of the student class at a particular school. One student may rank high at a less academically proficient school, but when rank is calculated for the same student with a high performing class the rank digresses. These indicators are valuable to college admission procedures; however, the use of a standardized achievement test provides a fair and precise measurement of current college and career readiness for students.

Notwithstanding the above, a significant concern within the debate of technology influences on student achievement and college and career readiness is funding. Irrespective of the progress made by ACT and the proposed use of benchmark scores as a fair and precise measurement for CCR for students, school funding and technology disparities are challenges for all educational organizations (McCord & Ellerson, 2009), but more so for rural areas (Lu & Overbaugh, 2009; Plopper & Conaway, 2013; Sundeen & Sundeen, 2013). Rural education is
growing across the United States and instigating a more diverse student population (Johnson, Showalter, Klein, & Lester, 2014). Johnson et al. (2014) suggested this growth and diversity will impact achievement gaps already prevalent in areas of low socioeconomic and minority subgroups. Although current federal policies support technology access and best practices development across the United States, local and state funding implications for next-generation technological-connected education are challenges and could affect overall outcomes for students.

The disparities between schools become the most evident based on the available types of technologies. Most schools share technology which limits student access with standalone computer labs and media centers. The labs provide common school-wide resources shared by students independently or scheduled for students by classes. Many schools across the nation have implemented one-to-one technology (1:1) initiatives or Bring Your Own Device (BYOD) programs. These programs are used to support the needs of the digital native students as well as reflect our technology-driven society. All approaches ensure student technology access at school and for uses in educational experiences. Past research, however, suggested technology access does not necessarily guarantee enhanced teaching and learning experiences (Holcomb, 2009). According to Holcomb, solely providing students access to technology does not automatically transform teaching and learning to improve achievement. Transformation is based on how the technology is used. For example, using technology as a tool or resource to personalize and connect learning through research, collaboration, creativity, and publication emphasizes types of strategies for transformative teaching and learning. Instructional shifts needed to incorporate innovative technology integration are lacking in current classroom practices (Norris & Soloway, 2011; Norris et al., 2011; Rosen & Beck-Hill, 2012). In many
classrooms, the technology has simply replaced another tool supporting traditional instructional practices (Rosen & Beck-Hill, 2012). However, the technology provides the potential to innovate beyond those traditional practices (Saavedra and Opfer, 2012; Spires et al., 2011). In the 2014-15 school year, more rigorous standards aligned to college and career readiness and accountability measurements demand both technology access and pedagogical shifts embracing technology (Achieve, Inc. et al., 2012; Gullen, 2014). To adequately prepare students beyond high school, technology should be used innovatively to support more student-centered learning experiences (Dede, 2014; Vockley, M., & Partnership for 21st Century Skills, 2007).

Technology integration at schools, particularly in rural areas, becomes more complicated by the demands of CCSS for student achievement in regard to technology access, instructional practices, and overall support. These new standards shift instruction in important ways from traditional teaching practices to more innovative designs. The CCSS are an initiative to provide states with common standards that define academic knowledge and skills for K-12 education (National Governors Association Center for Best Practices & Council of Chief State School Officers [NGA Center & CCSSO], 2010). The standards are grounded in college and career readiness concepts and are rich in content depth through a K-12 vertical alignment in English language arts (ELA) and math (NGA Center & CCSSO, 2010). The standards support 21st century skills of “creativity and innovation, critical thinking and problem solving, and communication and collaboration” (Partnership for 21st Century Skills [P21], n.d., para. 6) as well as align seamlessly with the International Society for Technology in Education (2007) standards for students. This triangular relationship of standards will help drive the pedagogical shifts needed to meet the demands of today’s society.
According to Saavedra and Opfer (2012), the student consumption practices in current classrooms need to transform to meet the needs of the current society. “Through the transmission model, students can learn information, but typically don’t have much practice applying the knowledge to new context, communicating it in complex ways, using it to solve problems, or using it as a platform to develop creativity” (Saavedra & Opfer, 2012, p. 9). The traditional teaching styles ensure students have content knowledge. However, traditional practices do not support students’ growth and understanding in using the learned knowledge for real-world productivity. The shift to CCSS needs the potential of technology in teaching and learning, as suggested by Saavedra and Opfer to ensure students meet the 21st century college and career readiness skills referenced in all sets of standards (i.e. ISTE, CCSS).

Thus, with the adoption of CCSS, the emergence of next-generation assessments is used to measure student proficiency of the standards and provide school accountability efforts. Two consortia, The Partnership for Assessment of College and Career Readiness (PARCC) and Smarter Balance Assessment, have developed next-generation assessments for testing implementation in the 2014-15 school year. Herman and Linn (2013) suggested that these technology-administered assessments will measure students on higher skills sets than those currently being assessed at many individual state levels. Herman and Linn suggested to properly “reflect essential capabilities for 21st century competence,” Norman Webb’s depth of knowledge (DOK) levels three and four items are necessary (p. 5). Herman and Linn’s (2013) review of both consortia’s current assessment development supports student measurements of deeper learning. At the same time, since these next-generation assessments are administered through technology mediums, it is important to recognize student technology proficiencies will play a significant role in student performance (Gullen, 2014).
The diverse changes in a globally connected society demand greater and more complex expectations for high school graduates for assurance of success in college and career. Concerns impacting those expectations fall within the K-12 educational arena, thereby creating the context for CCSS. Today’s schools are challenged to transform teaching and learning practices to meet the demands of new, more rigorous academic standards built around rigorous CCR skills with next-generation assessment measurements (Achieve, Inc. et al., 2012; Gullen, 2014). School agencies at the state and local levels are calculating funding decisions where new technology concerns are prevalent. Technology’s role in teaching and learning is pivotal for the educational transformation. Given disparities remain across the educational landscape in regard to technology access and integration opportunities, therefore, the digital divide across and between schools continues. Is it possible the lack of technological equality in student learning experiences might have devastating implications on students’ levels of readiness for success beyond high school?

**Purpose of the Study**

The purpose of this mixed-methods study was to examine the implications of technology access and integration for college and career readiness measurements of graduate cohorts from the same rural Mississippi geographical region. For the quantitative component of the study, the ACT® college readiness assessment was used to measure college and career readiness between a graduate cohort with 1:1 technology access and integration for four years in high school and a graduate cohort with limited or shared technology access and integration for four years in high school. For the qualitative aspect of the study, technology’s access and integration influences on college and career readiness were explored using focus groups, interviews, and recorded documentation with graduates, administration, and teachers from both
district high schools’ research sites. Combining both quantitative and qualitative data provided the framework for better understanding the emerging issues technology access and integration bring to contemporary demands and shifts in teaching and learning.

**Research Questions and Research Hypotheses**

The following research questions and hypotheses guided the study:

**Research Questions**

1. How do different levels of technology access and integration in high school learning experiences impact student readiness for academic and career experiences beyond high school?

2. Is there a significant difference in mean composite score on the ACT college readiness assessment between graduates in different levels of technology access and integration during a four-year high school experience?

3. Is there a significant difference in mean score in English on the ACT college readiness assessment between graduates in different levels of technology access and integration during a four-year high school experience?

4. Is there a significant difference in mean score in reading on the ACT college readiness assessment between graduates in different levels of technology access and integration during a four-year high school experience?

5. Is there a significant difference in mean score in math on the ACT college readiness assessment between graduates in different levels of technology access and integration during a four-year high school experience?
6. Is there a significant difference in mean score in science on the ACT college readiness assessment between graduates in different levels of technology access and integration during a four-year high school experience?

Research Hypotheses

1. There is no significant difference in 2014 graduate cohort student achievement based on mean composite score on the ACT® college readiness assessment for graduates in a 1:1 technology access and integration four-year high school experience compared to graduates in a limited or shared technology access and integration four-year high school experience.

2. There is no significant difference in 2014 graduate cohort student achievement based on mean score in English on the ACT® college readiness assessment between graduates in a 1:1 technology access and integration four-year high school experience compared to graduates in a limited or shared technology access and integration four-year high school experience.

3. There is no significant difference in 2014 graduate cohort student achievement based on mean score in reading on the ACT® college readiness assessment between graduates in a 1:1 technology access and integration four-year high school experience compared to graduates in a limited or shared technology access and integration four-year high school experience.

4. There is no significant difference in 2014 graduate cohort student achievement based on mean score in math on the ACT® college readiness assessment between graduates in a 1:1 technology access and integration four-year high school experience.
experience compared to graduates in a limited or shared technology access and integration four-year high school experience.

5. There is no significant difference in 2014 graduate cohort student achievement based on mean score in science on the ACT® college readiness assessment between graduates in a 1:1 technology access and integration four-year high school experience compared to graduates in a limited or shared technology access and integration four-year high school experience.

**Significance of Study**

The realm of education is in constant change to meet the evolving expectations of the current society. More so now than ever, transformational educational reform is at the center of a national debate. This educational reform is significant because different, more rigorously aligned standards are being implemented with new measurement practices for those standard proficiencies. Common Core State Standards and next-generation assessments initiate new conversations for funding issues, most specifically to ensure equal access and uses of technology for all teaching and learning experiences. According to the U.S. Department of Education (n.d.a), current teaching and learning practices demonstrate poor outcomes for recent graduates. “Today, about a third of American students require remedial education when they enter college, and current college attainment rates are not keeping pace with our country’s projected workforce needs.” (U.S. Department of Education, n.d.a, para. 3). This issue raises many concerns for K-12 schools. One significant concern is the inequality of technology resources in schools for developing and implementing new best practices for teaching and learning reflective of the globally connected workplace. This study examined the influences of
technology disparities on current CCR trends and sought to instigate conversations for adequate funding at state levels as well as revisiting budget trends at the local level.

Current teaching and learning practices are influenced by 20th century ideology and by NCLB legislative mandate. Both influences produce inconsistent results of technology’s impact on student achievement in past research. Amidst the current reform movement, it is important to address the challenges of change from traditional practices and past policy to transformational teaching and learning experiences. This study provides the framework for exploring the suggestions of integrating technology in a classroom as a means for improving learning outcomes and being accountable for those outcomes. As new standards grounded in college and career readiness and next-generation assessments proliferate, schools will be required to harness the potential of technology. This approach prompts the need for pedagogical shifts to develop appropriate skills and knowledge as demanded by CCSS for students as well as for the development of technology proficiencies needed to demonstrate those skills through next-generation assessments and other CCR indicators.

As schools make decisions for technology investments and implementation plans, the significance of this study provides insight about the critical concern of student level of technology access and integration on CCSS proficiency performance and CCR standards. To better understand this phenomenon, exploring current technology access and integration influences on CCR standards and college readiness benchmark measurements provide a foundation for the possible shifts needed with new standards focused on CCR and next-generation assessment implementation. Hence, this mixed-method study examined different levels of technology access and integration between two school districts in one rural county in Mississippi. Examining the impact of technology on student performance on current CCR
benchmarks measurements and exploring the perceptions and attitudes of educators and students about technology and college and career readiness provide invaluable and timely information for current educational reform efforts. In effect, the study brings attention to future educational funding considerations to examine technology inequalities and find support for the possible technological resources needed for all students to meet the new CCSS as measured through next-generation assessments and be successful beyond high school.

Limitations of the Research Study

The following limitations evolved from this study:

1. The ACT® college readiness benchmark assessment was administered through paper and pencil and did not incorporate any performance-based items. This does not reflect educational reform trends for next-generation assessment measurements of CCSS anchored in CCR.

2. Socioeconomic status (SES) and race are both subgroup indicators where past research proposes meaningful impacts on student achievement performance measurements (Brown-Jeffy, 2009; Okpala, Okpala, & Smith, 2001). Since the participating districts’ demographically aggregated data showed similarities in SES and significant differences in race, it is important to recognize the identified differences for SES and race within the four participating high schools. Neither SES nor race variables were measured within this study nor were they controlled for in the study. Therefore, result inferences of this study will be made cautiously.

3. Expenditures per pupil were significantly different between the two school districts.
This difference suggested concerns when examining student achievement with no control for the financial variable.

4. As a former employee of one of the schools and current employee within the same school district, the current researcher’s personal experiences provide a more informed perspective about the implementation processes involved with the diverse uses of technology in teaching and learning. Consequently, careful attention was taken by the researcher to distinguish between fact and opinion.

**Definitions in the Research Study**

For purposes of this study, the following terms were defined:

1. *ACT®*. The term ACT® refers to the ACT® assessment program including the overall assessment encompassing English, reading, math, and science as well as the independent subject specific assessments.

2. *ACT, Inc.*. For purposes of referencing, ACT, Inc. was used to identify the nonprofit organization’s research, reports, and policy publications in support of the ACT® assessment program.

3. *College and career readiness (CCR)*. CCR consists of a student having adequate content knowledge and skills sets to be successful in college or a career path after graduating from high school (Conley, 2014b).

4. *Common Core State Standards (CCSS)*. The CCSS is a set of educational standards grounded in college and career readiness anchor standards specifying what students should know in English and math content areas in K-12 education (NGA Center & CCSSO, 2010).

6. *Digital native students.* According to Prensky (2001), “Our students today are all ‘native speakers’ of the digital language of computers, video games and the Internet” (p. 1). Prensky described digital native students as born into our technology world engrossed by the skills and knowledge of a technology-driven society.

7. *Levels of technology integration.* To effectively integrate technology a teacher “... would be able to draw on extensive content knowledge and pedagogical knowledge, in combination with technological knowledge” (Pierson, 2001, p. 427). The definition suggests a teacher’s knowledge base of content, pedagogy, and technology as significant for effectively reaching learner outcomes using technology. For the purposes of this study, exploration of levels of technology revolved around the TPACK framework and SAMR model. The TPCK framework supports content, pedagogy, and technological knowledge relationships where the “approach emphasis the connections and interactions between these three elements” (Koehler & Mishra, 2005, p. 133) as the framework acronym has been updated to TPACK to support “an integrated whole” (Thompson & Mishra, 2007, p. 38). The SAMR model encompasses a guide of different levels of technology uses affecting student learning (Puentedura, 2008). The model represents substitution, augmentation, modification, and redefinition. Each level identified a specific
description of how technology is used in the student learning experience.

PuenteDura (2008) defined each level as follows:

- substitution: tech acts as a direct tool substitute, with no functional change;
- augmentation: tech acts as a direct tool substitute, with functional improvement;
- modification: tech allows for significant task redesign;
- redefinition: tech allows for the creation of new tasks, previously inconceivable. (13:23)

8. Levels of technology access. (a) One-to-one Technology (1:1): student access to a technological medium (e.g., computer, laptop, iPad, tablet, etc.) 24/7 throughout the school year provided by the school; (b) Bring Your Own Device: an initiative where students are allowed to bring their own personal technology device (e.g., laptop, tablet, etc.) to school for educational purposes; and (c) Limited or Shared Technology represents the use of shared technology devices (e.g., computer lab, shared technology cart, etc.) within a school among students throughout the school day which limits each student access and use in daily learning experiences.

9. Next-generation assessments. This term represents high-stakes assessments measurement of CCSS through technology-based mediums. Smarter Balance and PARCC consortia have developed next-generation assessments for implementation in the 2014-15 school year.

10. Rural and urban schools. The U.S. Census Bureau (2013b) uses population density to identify urban and rural areas where urban areas also “encompass residential, commercial, and non-residential urban land uses” (para 1). There are two classifications for urban areas. “Urbanized Areas” have a population of over 50,000, and “Urban Clusters” have a population from 2,500 to < 50,000 (U.S. Census Bureau, 2013b). For the purposes of this study, the following information
clarifies rural and urban definitions of the districts and schools participating. According to the U.S. Census Bureau (2013a), District A, with one high school, resides in an “Urban Cluster” category identified in the 2010 census. District B, with 3 high schools, resides in a rural category defined by the 2010 census as “encompasses all population, housing, and territory not included within an urban area” (U.S. Census Bureau, 2013a, para 3). The U.S. Department of Education (n.d.b) uses locale codes to identify rural and urban schools and districts based on the U.S. Census Bureau urban-rural geographical classification. The following codes identify the districts and schools involved in the study:

- **Town, Remote:** Territory inside an urban cluster that is more than 35 miles from an urbanized area. 
- **Rural, Fringe:** Census-defined rural territory that is less than or equal to 5 miles from an urbanized area, as well as rural territory that is less than or equal to 2.5 miles from an urban cluster. 
- **Rural, Distant:** Census-defined rural territory that is more than 5 miles but less than or equal to 25 miles from an urbanized area, as well as rural territory that is more than 2.5 miles but less than or equal to 10 miles from an urban cluster. (U.S. Department of Education, n.d.b, para 14)

For the 2011-12 school year, the U.S. Department of Education (n.d.d) categorized District A as “Town, Remote” with one high school identified as “Rural, Fringe.” District B was categorized as “Rural, Distant” (U.S. Department of Education, n.d.d). District B has one high school identified as “Rural Fringe” and two high schools categorized as “Rural Distant” (U.S. Department of Education, n.d.c).
Summary

Today’s schools are challenged with transformational change to meet the new demands and expectations of educating a 21st century global citizen. This study examined technology’s role in current CCR measurements and student perceptions to address shifts in standards, assessment, technology inequalities, and adequate funding implications. The significance of the study was grounded on concerns to ensure that today’s K-12 students have the needed technology resources and tools to develop 21st century skills as well as a strong content knowledge base. Using current CCR measurement data and exploring authentic student perceptions and attitudes will offer an opportunity to ascertain significant results that will generate valuable discussion for school leaders in making decisions to improve teaching and learning in all schools.
CHAPTER II
LITERATURE REVIEW

The 21st century society demands a new citizen who is more than knowledgeable, yet one who also has the skill set to create new knowledge. Current teaching and learning practices revolve around traditional mindsets and, therefore, are undermining students’ potential and developing them as ill-prepared for life in a global society. The implementation of new, rigorous standards and next-generation assessments with a redefined focus on college and career readiness will require a pedagogical shift in classrooms across the United States (Achieve et al., 2012; Gullen, 2014). The role of technology is important to current and future teaching and learning practices. Thus, it is imperative to explore current technology trends, federal and state policy implications, and perspectives impacting rural educational landscapes.

Current literature of technology’s influences on teaching and learning is significant because it demonstrates the inconsistencies of research findings. The technology impacts prevalent today are skewed based on the complexities of technology access and integration in the effects on teaching and learning and on student achievement (Bebell & O’Dwyer; 2010, Bebell et al., 2010; Dunleavy et al., 2007; Holcomb, 2009; Norris & Soloway, 2011; Norris et al., 2011; Rosen & Beck-Hill, 2012; Spires et al., 2012). The most documented implications of these varied results are the teacher instructional practices and curricula boundaries. According to Norris and Soloway (2011), pedagogy plays a significant role in the effectiveness of technology integration. Without the shift of “disruptive transformation” from traditional practices to more student-centered environments, technology’s role will be insignificant in
student achievement (Norris & Soloway, 2011, p. 3). Rosen and Beck-Hill’s (2012) research indicated more positive learning outcomes when technology is integrated through a more constructivist context. Norris et al., (2011) also suggested current curricula stymie technology integration because it supports traditional instructional practices. Therefore, the most profound suggestion to harness the potential of purposeful and intentional technology integration to increase student achievement is a shift in both pedagogy and curricula.

The influences of federal and state policy show historical barriers of using technology and future implications on harvesting those same technologies for new challenges. No Child Left Behind, Common Core State Standards, College and Career Readiness, and next-generation assessments all play a part in the use of technology in teaching and learning, thereby instigating a shift from traditional practices.

Rural education interests have been a core concern for educational reform throughout history. Achievement issues correlated with funding, resources, and quality teaching and learning environments have always been present. In changing the educational landscape to meet the demands of a 21st century society, these rural educational concerns and the need for technological integration to support enhanced academic outcomes have become even more prevalent.

**Policy Influences on Technological Innovations in K-12 Educational Context**

**No Child Left Behind**

The No Child Left Behind (NCLB) legislation of 2001 mandates individual state accountability measurements in all public schools (U.S. Department of Education, 2003). Currently, each individual state has developed its own content standards and high-stakes assessments to measure students’ performance in ELA and math in Grades 3 through 8 as well
as science in elementary, middle, and high school. After 10 years of NCLB, the influences of high-stakes testing and school accountability on teaching and learning have surfaced.

Peterson and Hess (2008) present disconnect between the mandate and actual teaching and learning accountability practices. Since states develop their own content standards and define proficiency within the measurement of the standards, they suggest one is unable to compare performance results from state to state. In 2003, 2005, and 2007, Peterson and Hess (2008) uncovered state discrepancies by measuring reading and math proficiency levels in Grades 4 and 8 and comparing each state to the National Assessment of Educational Progress assessment proficiency level. The findings of Peterson and Hess showed a gap of proficiency levels between the states as well as a steady decline in standards from the first measurement in 2003. Their evidence suggests NCLB accountability created such pressures for performance that states developed low proficiency levels to help meet the needs of the legislation.

Another outcome of NCLB was the initiation of concerns of what is taught in schools and how teaching and learning transpire during the high-stakes accountability era, such as implications of teaching to the test and school focus on only the tested areas (Britannica Editors, 2010; Center on Educational Policy, 2008; Dee & Jacob, 2011; Groen, 2012; Starr, 2012; Zhao, 2012). These concerns give significant alarm to current classroom practices. According to the Center of Educational Policy (2008), key findings showed almost a 50% increase and focus on ELA and math at the decreased instruction of other subjects including social studies, fine arts, and physical education. Educational psychologist Kyung Hee Kim claimed that, “If society stifles interests in developing individual differences, creative and innovative thinking, or individual potential, and eliminates the opportunities for creative students to release their creative energy in school, this may cause problems in the future”
At the same time Starr (2012) suggested the demands of high-stakes testing narrow teacher freedoms to develop instruction beyond the scope of the tested content, therefore, “. . . not inspiring critical thinking” (p. 245). This evidence suggests that during the era of high-stakes testing and school accountability, schools have limited their instruction to meet only the aspects of those accountability demands. Therefore, cognitive processes have not been a focus in teaching and learning.

In 2011, the U.S. Department of Education (2012a) recognized the limitations of NCLB and offered state and local agencies waivers from specific provisions set in the Elementary and Secondary School Act of 1965 (ESEA). These flexibility waivers are requested and granted by addressing specific criteria for school improvement including the adoption of English and math standards based on college and career readiness, with high-quality assessments aligned to these standards to measure student growth (U.S. Department of Education, 2012a).

No Child Left Behind, Title II, Part D also incorporates technology integration development identified as Enhancing Education Through Technology Act of 2001 (EETT). This aspect built a setting of specific purposes for the use of technology in all public schools (U.S. Department of Education, 2002). The program assists schools with grants and support to meet the needs of all students. The goal of EETT was “. . . to improve student academic achievement through the use of technology in elementary and secondary schools” (U.S. Department of Education, 2002, p. 2). New funding for EETT under the American Recovery and Reinvestment of Act of 2009 helped support continued federal funding allocations for grants (U.S. Department of Education, 2009). In 2009, the ARRA support provided $650 million for the EETT grant program where all states benefited (Duffey & Fox, 2012). The allocation benefits supported the use of technology to improve student achievement, building
teacher capacity for effective technology integration, and ensuring student technology proficiencies (Duffey & Fox., 2012).

Although technology trends supporting EETT, such as shared, 1:1, and BYOD implementation, established efficient opportunities for pedagogical shifts, other NCLB mandates, such as pencil and paper high-stakes testing, stymied the actual practices. Shapley, Sheehan, Maloney, and Caranikas-Walker (2011) described “disappointing results” for investments in ubiquitous technology environments for the sole purpose “... to improve standardized test scores. ...” (p. 312). The implication for technology-rich environments, therefore, support the current consensus among researchers that innovative uses of the technology for cognitive and metacognitive learning is not the norm, but an underused medium replicating traditional teaching and learning practices (Norris & Soloway, 2011, Norris et al., 2011, Rosen & Beck-Hill, 2012). This evidence suggested NCLB promotes and supports technology integration, but also stifles its use by the demands and pressures of high-stakes testing accountability.

**College and Career Readiness**

The concept of college and career readiness (CCR) is a combination of academic knowledge and skill sets needed for students to be prepared for success in entering a 21st century society. Each aspect of readiness has evolved over the years initially as individual and separate idioms (Conley & McGaughy, 2012). Just within the last decade, the educational culture of the United States has recognized a need to join both baseline readiness for college and career to prepare all of today’s students to be successful tomorrow.

According to Conley and McGaughy (2012), historically, career readiness was synonymous with vocational training for an industrial workforce. Today’s new globally
connected workforce has instigated a shift in this definition of career readiness. The shift stems from the demands of a changing world with a different workforce and new economy (Conley, 2014a, Conley, 2014b). “All of this unpredictable, uncontrollable change results in periodic tectonic shifts that ripple through sectors of the economy and society, creating disruption and making some entire career areas instantly obsolete while, at the same time, generating entirely new opportunities” (Conley, 2014b, p.13). Conley suggested being successful in today’s ever-changing workforce and economy as well as in the future will be dependent not just own one’s own knowledge base but on the ability of continuous learning. “Schooling will truly need to be about enabling students to learn throughout their careers” (Conley, 2014a, p. 20). According to Conley, today’s K-12 student needs to develop skills supporting “how to learn” in order to develop a personalized lifelong learning paradigm to ensure success.

A study developed by Standards for Success in 2003 resulted in the first established standards designed to address college readiness (Conley, 2003; Conley & McGaughy, 2012). These standards encompassed content knowledge as well as specific skills needed for students to be successful in college (Conley, 2003; Conley & McGaughy, 2012). These researchers reported the skills included were critical-thinking, problem solving, and a host of other specific abilities designed to support success in college and lifelong learning endeavors. In 2002, three organizations Achieve, Inc., Education Trust, and the Thomas B. Fordham Foundation (2004) partnered in a research endeavor called the American Diploma Project. The two-year research project drew both from the educational culture and workforce society. “In our research we found an important convergence around the core knowledge and skills that both colleges and employers . . . require” (Achieve et al., 2004, p. 4). Their work resulted in English and math benchmarks built upon college and career readiness skills to help guide K-12 educators in
developing state standards beyond content specifics to incorporate the skills needed to be successful post-high school regardless if students were joining the workforce or continuing their academic career (Achieve et al., 2004). Beliefs that specific knowledge and skills are essential for success in both higher education or today’s workforce, their work helped develop a roadmap for K-12 schools to incorporate college and career readiness skills in their state standards.

Defining and assessing career readiness, however, still varies across the states. According to Frizzel, McIntosh, and McMurrer (2013), less than half of states participating in their study had developed a career readiness definition. Frizzel et al. also revealed a variety of assessments used to measure career readiness ranging within academic scope to technical aspects. These variations of definition and measurement created a host of inconsistencies across the United States ensuring a national challenge in tackling college and career readiness in a broad spectrum.

ACT, Inc. has led the United States through research and development in helping measure student readiness for college. Its assessment program provides formative data for students from Grade 8 through high school and ultimately is used for admission purposes for two-year and four-year colleges. ACT® has identified specific benchmarks throughout its assessment program to help determine probability of success in college courses in English, math, reading, and science (ACT, Inc., 2012). Research of ACT, Inc. (2006b) confirmed correlations between college and career skills needed to be successful suggesting all students should be measured to these same standards regardless of student intents after high school. The ACT, Inc. (2014a) organization originally created and published the College Readiness Standards. However, ACT, Inc. (2014a) has continued revisions and updates of these standards
and in 2013 rebranded them as the ACT College and Career Readiness Standards. According to ACT, Inc. (2014a), this effort was designed to ensure validity of standards and assessment programs as well as support commonalities with other college and career readiness standards, most particularly the CCSS.

In an annual study on our nation’s condition of college and career readiness, ACT, Inc. (2014d) reported that 57% of all 2014 high school graduates took the ACT®, a bump of 18% since 2010. However, only 26% of those graduates demonstrated attainment of the college and career readiness standards in all four subject areas (English, math, science, and reading)—an improvement of only 2% since 2010 (Act, Inc., 2014d). Benchmarks scores are set in each subject area to signify probability of success in each subject area entry-level college course. Research by ACT, Inc. (2014d) suggested that, “gains in achievement are common in states that create an educational culture focused on college and career readiness” (p. 3). Mississippi demonstrated similar trends over the four years, however, at a much lower percentage level with 12% students meeting benchmark scores in all four subjects—an increase from 10% in 2010 (ACT, 2014c). Although Mississippi’s performance level is lower than the national level when measuring college and career readiness in all four subject areas, its 2% gain is right on mark with the nation. This gain indicates a focus on college and career readiness in Mississippi and positive growth in the area.

According to one research project, ACT® imperfectly uses the four content assessment subscores to predict student success in college (Bettinger et al., 2013). Bettinger et al.’s research proposed only the ACT® English and math scores can adequately predict success, “. . . Mathematics and English scores are much more tightly correlated with college success than are reading and science scores. In fact, after controlling for math and English scores, reading and
science provided essentially no predictive power regarding college outcomes” (p. 27). This research indicates a concern for the effective uses of the ACT® composite benchmark score as a predictor for college and career readiness. Overall, Bettinger et al (2013) suggested the use of an English and math composite score as a stronger predictive indicator for college admissions and the use of an ACT® composite including reading and science possibly promotes inclusion of students who are not adequately prepared to enter college.

Although studies by ACT (2006b) and Achieve, Inc. et al. (2004) suggested college readiness and career readiness as comparable, it is important to recognize concerns stemming from its equality. Camara (2013) suggested the use of test scores to identify college readiness as sufficient, however, to blankly include career readiness as shortsighted. Camara (2013) proposed several reasons, including the following: “A single cut score or benchmark may not serve the verse types of postsecondary career-training institutions and programs which exist” (p. 21). Other researchers concluded the same sentiment suggesting there are some overlapping elements between college readiness and career readiness, but content knowledge and skills defined beyond English and math are needed to adequately determine postsecondary success (Camara, 2013; Conley, 2014b, Conley & McGaughy, 2012).

Educational reform has brought college and career readiness to the forefront of our society’s livelihood agenda. The 2012 Center on Educational Policy publication, State High School Exit Exams: A Policy in Transition, suggested the federal government support through Race to the Top, and NCLB waivers have initiated statewide initiatives for evaluating current content standards and assessment programs (McIntosh, 2012). State and federal policy are both driving the adoption of CCSS and next-generation assessments focused on measuring not only
content knowledge but also college and career readiness skills. McIntosh (2012) also confirmed educational leaders are making decisions according to the following:

... whether to revise or replace their current exit exams to meet college- and career-readiness standards, whether consortia-developed assessments can be used for the same purposes as their current exit exams, and whether to require students to pass an exam aligned to more rigorous college and career expectations in order to graduate. (p. 23)

Education agencies are amidst transitional changes that continue to impact teaching and learning. According to the U.S. Department of Education (n.d.j), as of September 2014, 43 states have been granted NCLB flexibility waivers and two states are currently under review. In exchange for these waivers, each state has addressed specific principles “to increase the quality of instruction for students and improve student academic achievement” (U.S. Department of Education, 2012a, p. 1). This effort indicates a powerful nationwide focus on college and career readiness standards with aligned assessments as accountability indicators for states and schools.

In an era of ubiquitous technology in education and a redefined focus on standards and assessments, the United States educational landscape is changing drastically. College and career standards provide policymakers with a roadmap to help ensure students not only build core knowledge but also develop and strengthen the skill sets needed for the students to be successful in the future. Technology helps support that roadmap and foster a continuous educational environment for anytime, anywhere learning as well as strengthen opportunities for collaboration, publication, critical thinking, and problem-solving.

**Common Core State Standards**

The Common Core State Standards (CCSS) provide an opportunity to redesign teaching and learning for the 21st century. The common standards define content knowledge and also
describe what students should be able to demonstrate (NGA Center & CCSSO, 2010). State adoption of these standards will require pedagogical shifts in teaching and learning (Achieve, Inc. et al., 2012; Sawchuk, 2012). The standards are anchored in college and career readiness foundations for reading, writing, speaking and listening, and language (NGA Center & CCSSO, 2010). These standards provide K-12 vertically aligned standards in ELA, math and literacy in history/social studies, science, and technical subjects (NGA Center & CCSSO, 2010). Achieve et al. (2004) criticized the current or previous state standards as being all content specific with no connection to real-world applications, therefore, lacking in college and career readiness standards. These standards will provide a common thread to develop the content knowledge base and 21st century skills needed to be successful in a global society.

The Partnership for 21st century skills (P21) has developed and defined “learning and innovations skills” needed to prepare students “for increasingly complex life and work environments in the 21st century” including “creativity and innovation, critical thinking and problem solving, and communication and collaboration” (P21, n.d., para. 6). These student outcome skills identified as part of P21 framework encompass the high-level cognitive process often described as lacking in traditional teaching and learning environments. According to P21, these skills are the required ingredients for success in today’s society. As suggested by P21, students need the ability to think creatively about a variety of situations both independently and collaboratively as well as be able to analyze, evaluate, and synthesize information and data to solve problems. Students also need verbal and written communication skills as well as abilities to work productively with others (P21, n.d.).

The International Society for Technology in Education (ISTE) defined six student standards: “creativity and innovation, communication and collaboration, research and
information fluency, critical thinking, problem-solving and decision making” (International Society for Technology Education, 2007, para 1-6). The standards boast they are “the standards for learning, teaching and leading in the digital age” (International Society for Technology Education, 2015, para 2). According to ISTE (2014), these standards can be implemented across all curriculum helping develop and support the skills needed to be productive in today’s society. Using these standards to guide technology integration in all content areas will help ensure development of digital literacy supporting 21st century skills.

The CCSS support the development and uses of these skills as described by P21 and ISTE because they are built into the standards. Technology integration will play a vital role in the development of these skills (Saavedra & Opfer, 2012). The challenges presented by CCSS are the current traditional instructional practices and the lack of technology innovation developed as an integral part of teaching and learning. According to Saavedra and Opfer (2012), transformation from the “transmission model to the 21st century model has important implications for the entire educational system” (p. 12). Saavedra and Opfer (2012) suggested the needed changes in education will rely on the very skills that educators are trying to teach.

**National Technology Plan**

Recognizing a need to support transition to a 21st century educational landscape, the Office of Educational Technology (OET) at the U.S. Department of Education (2010) developed a national technology plan in 2010 outlining specific goals and providing resource guidance for states and local agencies to meet those goals. The plan instigated a charge to redesign traditional teaching and learning practices through the use of technology. The plan asserts the following:
schools must be more than information factories; they must be incubators of exploration and invention. Educators must be more than information experts; they must be collaborators in learning, seeking new knowledge and constantly acquiring new skills alongside their students. Students must be fully engaged in school—intellectually, socially, and emotionally. This level of engagement requires the chance to work on interesting and relevant projects, the use of technology environments and resources, and access to an extended social network of adults and peers who support their intellectual growth. (U.S. Department of Education, 2010, p. 1)

The plan focused on five goals with embedded recommendations to meet those goals addressing student engagement, assessment, professional connectedness, technology infrastructure, and using technology to transformational potential (U.S. Department of Education, 2010). The first goal in the plan, “Learning: Engage and Empower,” revolves around the premise that traditional teaching and learning experiences do not correlate with today’s 21st century technology-rich societal practices. This goal outlines a model for schools “. . . to leverage technology to create relevant learning experiences that mirror students’ daily lives and the reality of their futures” (U.S. Department of Education, 2010, p. 9). This model relied on student-centered learning experiences for all children supported by the full potential of technology for anytime, anywhere learning.

The second goal, “Assessment: Measure What Matters,” supports the current educational reform ensued by CCSS and next-generation assessments. Addressed in this goal are assessment practices going beyond what students know to also include assessment of higher-order process in performance-based items to demonstrate what students can do through the use of technological modalities (U.S. Department of Education, 2010). This goal also encompasses the use of technology to better serve data-driven decisions for ongoing formative information of student learning to guide instruction and improve teaching and learning (U.S. Department of Education, 2010).
The third goal, “Teaching: Prepare and Connect,” addresses teacher professional competence levels in today’s ever-changing educational landscape (U.S. Department of Education, 2010). This goal suggests the need for ongoing support through professional learning for teachers with and through the use of technology resources and tools. The fourth goal, “Infrastructure: Access and Enable,” supports the need to ensure lifelong learning through connectivity by building an “infrastructure for learning . . . to support a learning society in which learning is lifelong and lifewide” (U.S. Department of Education, 2010, p. 51). This infrastructure includes broadband connectivity across the nation as well as addressing the challenges of student access to technological devices (U.S. Department of Education, 2010). This goal relies on the idea that students must have access and availability for learning inside and outside the classroom through the use of technology.

The fifth goal, “Productivity: Redesign and Transform,” focuses on the need to harness the full potential of technology to ensure effective educational practices that are efficient and productive for all learners (U.S. Department of Education, 2010). This goal suggests considerations beyond traditional 20th century educational environments to include inventive learning models supported by technology to ensure personalized learning experiences for all students. Kennedy (2010) proposes this plan “. . . will produce better prepared students, more effective teaching, more authentic assessments of student performance, more accessible learning resources and more productive school systems” (p. 16). The National Educational Technology Plan encompasses a variety of goals to address the needed changes for educational agencies to effectively use technology in supporting a 21st century learning experiences for today’s students.
In Duffey and Fox’s (2012) trends analysis, changes in the educational landscape were identified through four areas ranging from infrastructure to specifics concerning college and career readiness. “Integrating technology into the core curriculum provides opportunities for students to access both advanced and credit recover courses, as well as, utilize hardware and software tools associated with modern careers and business” (Duffey & Fox, 2012, p. 1).

Recognizing a national trend dedicated to the relationship of technology use and college and career readiness demonstrates a common understanding of the benefits technology can provide for today’s student.

**Technology Innovations on K-12 Educational Context**

**One-to-One**

In response to meeting today’s students’ needs and expectations of society, one-to-one (1:1) laptop initiatives have been implemented in schools across the United States. These types of initiatives allow teachers and students to have access to a laptop computer or mobile device throughout the school year as a teaching and learning tool. This access narrows the digital divide within a school allowing all students access to 24/7 learning opportunities transcending previous educational structures of the past and promoting lifelong learning practices. One-to-one technology initiatives provide laptops, iPads, iPods, tablets, and other ubiquitous technology tools in the hands of every student, as opposed to shared devices, to enhance teaching and learning. According to Bebell and O’Dwyer (2010), the definition only “. . . refers to the level at which access to technology is available” (p. 6). Again, the conundrum of technology access and variations of use develop implications for qualms in research studies on effects in teaching and learning or student achievement (Bebell & O’Dwyer, 2010; Bebell et al., 2010; Dunleavy et al., 2007; Holcomb, 2009; Norris & Soloway, 2011; Norris et al., 2011;
Rosen & Beck-Hill, 2012; Spires et al., 2011). The idea of a one-to-one technology program in schools supports 21st century lifestyle. However, research focus on technology access and implementation undervalues the importance of pedagogy and curriculum impacts on student achievement when exploring effective technology integration.

Research surrounding one-to-one programs provides minimal information for understanding the program’s impact on teaching and learning (Bebel & O’Dwyer, 2010; Dunleavy et al., 2007; Spires et al., 2011). As technology continues to advance and the digital natives of this country go through their educational careers, it is inevitable technology will play a major role in the educational experiences of 21st century students. Recognizing the need for pedagogical shifts and the tools to drive this change is imperative to education reform.

“Previous research advises that in order to see the impact of computer use in education, it should be used more frequently and effectively in teaching and learning” (Lowther, Inan, Ross, & Strahl, 2012, p. 2). The lack of research examining the teacher’s role in the pedagogical partnership with instructional technology, the misconceptions of use in a ubiquitous learning environment, and the mixed findings of impact on student achievement provide a need for further research.

**Bring Your Own Device**

A Bring Your Own Device (BYOD) program allows students to individualize their technology preferences for the learning experience by bringing their own device to school. This model provides a solution for what many critics of a 1:1 initiative consider financially unsustainable (Norris & Soloway, 2011). It also supports the concept and reality of the 21st century society. Mobile devices are a part of today’s students’ lives (Johnson, Adams, & Haywood, 2011; Traxler, 2010). It only makes sense to allow students to use these devices as
part of their learning experiences. According to Norris and Soloway (2011), “While all other
technologies in K-12 have been brought into the classroom by adults, this time it is the students
themselves that are bringing in their own personal technology” (p. 10). Their suggestion
indicates a transformation toward personalized learning. In the past, teachers and
administration have dictated specific tools and resources. Now, students have a voice and
opportunity to use the technological tool or resource they need to support their own learning
experience.

BYOD programs are subject to many challenges. The concern of access appears. Do all students have access to a personal device or will access equity play a role (Hill, 2011)? As
developed in the previous section, research on technology integration or use in the classroom in
a 1:1 program has proven inadequate and underdeveloped (Bebell & O’Dwyer, 2010; Bebell et
al., 2010; Dunleavy et al., 2007; Spires, et al., 2011). The BYOD model simply eliminates
school budgetary issues but does not address pedagogical shifts. Another concern is the
connectivity and technology support needed to maintain a BYOD program (Raths, 2012).
Currently, schools have a very narrow approach to maintaining a technological infrastructure
and providing connectivity. In the past the technology tools have been proprietary to maintain
small support staffs as well as to sustain low purchasing cost. Are educational institutions
equipped for this support and the maintenance of diverse tools and resources compounded by a
BYOD environment? Will the impact of BYOD indicate high cost for infrastructure and
connectivity to meet this diversity? Regardless of the challenges, BYOD programs are
surfacing as means for student access and use for teaching and learning experiences.
ConnectED Initiative

In 2013, the Obama Administration introduced the ConnectEd Initiative to ensure schools have high-speed Internet connectivity within the next five years (White House, 2013). This administration’s recognition of connectivity and technology as powerful resources to support innovative teaching and learning practices supports the National Educational Technology Plan’s specific goals for schools. Obama’s plan addressed not only connectivity and tools, but also teacher training to support technology-infused teaching and learning practices. Implementation of this initiative relies heavily on partnerships within the government and private sector. “The initiative would foster a robust ecosystem for digital learning” (White House, 2013, p. 2). The most significant aspect of the initiative will come to those rural areas lacking a digital connectivity (White House, 2013). This support will ensure equity across all schools and for all students.

The ConnectEd Initiative relies on a partnership with other government and corporate funding opportunities to supplement schools with cutting-edge technology connectivity and tools (White House, 2013). Currently, this partnership has garnered over $750 million from private technology companies including Apple and Microsoft as well as other for-profit organizations (White House, 2014). The Federal Communication Commission announced $2 billion funding to support the ConnectEd Initiative earned through the federal E-Rate program (The White House, 2014). Through a collaborative effort in all areas of society, the lofty goals addressed in the National Educational Technology Plan and the demands of Obama’s ConnectEd Initiative, the current educational landscape of schools will begin to shift to meet the needs of today’s 21st century student.
According to the United States Department of Education (n.d.h), current technology and connectivity in schools are either nonexistent or lacking. “Today, fewer than 30% of schools have the broadband they need to teach using today’s technology” (White House, 2014, para. 6). The ConnectEd Initiative ensures “next-generation broadband” connectivity to all schools across the nation within the next three years (White House, 2014). All schools will be connected and will have the level of connectivity needed to provide technology access to resources and tools for effective productivity in 21st century teaching and learning experiences.

The plan goes beyond broadband connectivity by also including the support of ongoing professional development to grow teachers with innovative, transformational teaching and learning strategies through the use of technology (White House, 2013; U.S. Department of Education, n.d.i). Obama’s ConnectEducators is a program targeting this teacher training. Obama has requested a budget of $200 million in funding of grants for states and districts to build and supplement a digital learning environments (U.S. Department of Education, n.d.i). These efforts will help teachers benefit from the “next-generation broadband” connectivity and access by understanding and developing best practices for using technology to its full potential in teaching and learning (U.S. Department of Education, n.d.i).

**Perspective Implications of Student Achievement on Technological Innovation in K-12 Educational Context**

**Technology Access and Integration**

Currently, it is believed that the use of technology will enhance teaching and learning and provide today’s students with relevant experiences to help develop skills for them to be successful in the future (Bebell et al., 2010). Bebell et al. (2010) expressed a concern over the abundance and variety of definitions of “technology use,” especially as technology continues to
advance and those uses change in an educational setting, thereby skewing research results. Bebell et al. (2010) suggested a variety of research data confuses technology “access” as equal to “technology use.” In Lei and Zhao’s (2008) study, it was documented that most of the previous research was “on the implementation process and whether it works, without sufficient data to picture how students use their own laptops” (p. 101). Therefore, Lei and Zhao suggested research focuses on how schools provide students with technology with no substantial interest on how the technology is used. This suggestion strengthens the misunderstanding that providing technology equates to effective technology uses. With limited research studies available, Rosen and Beck-Hill (2012) suggested the cause of these mixed results is due to how the technology is used—some using technology as a replacement for traditional tools and others using technology to help drive a change in how teachers teach and students learn. For example, students may complete an electronic worksheet, take notes, or read text on their laptop. These practices have not changed the students’ learning experiences. The tool used for the learning experience has been the only change.

Such evidence suggests needs for pedagogical shifts to fulfill technology potential to generate positive effects on teaching and learning. Therefore, conclusions from past research launch a need to understand the relationship of technology use for learning with new pedagogical foundations and that relationship’s effect on student achievement and meeting today’s academic standards.

Some of the mixed evidence in educational technology research could stem from the misunderstandings that merely providing the technology does not in turn signify enhanced learning experiences and, therefore, improved student achievement (Holcomb, 2009). However, in the next-generation assessments era where high-stakes test will be administered
through computer-based mediums, simple “access” may have a significant impact on the student performance outcome. Students will be expected to have technological skills to maneuver through text by highlighting or dragging and dropping words or sentences to support multiple-choice answers as well as have a background of digital literacy to access a variety of media and demonstrate writing through typing (Fink, 2013; Gullen, 2014). The ELA CCSS writing strand includes specific mention of technology tools across all grade levels where consistent “access” and familiarity would have prevalent impacts on students’ technology skills. In examining these standards, it is easy to see how technology uses will play a vital role in students’ daily educational experience. For example, there are specific references to writing using keyboarding skills. The standards also have explicitly written references to other technological resources and specific skills, such as publication and collaboration through the use of technology.

With new standards grounded in college and career readiness skills and new assessments, the simplest technology access and use in traditional ways and technology use to instigate innovative pedagogical shifts will have some effects on teaching and learning. Technology will have a significant impact on students’ abilities to demonstrate understanding and skill sets on high-stakes assessments (Achieve et al., 2012; Gullen, 2014). Implications for technology integration and access are vital in proficiency levels of CCSS and next-generation performance measurements that will also gauge college and career readiness indicators.

**Geographical Location**

Rural education is a significant concern in the United States as it was represented in 58% of public school districts during the 2011-12 school year where 32% of the nation’s students are enrolled in a rural elementary or secondary public school (U.S. Department of
Education, n.d.; U.S. Department of Education, n.d.f). These statistics are based on the new locale classification system built with the Census Bureau in 2006 to help identify rural areas beyond just population but also in proximity to urban areas (U.S. Department of Education, n.d.g). Research shows a trend of rural student populations in public schools on the rise (Johnson et al., 2014). Over five years Johnson et al.’s research studies have calculated school population growths in rural areas as higher than those in urban areas across the United States. This growth implies that, “a continued and expanding salience of rural education for the nation’s public education as a whole” (Johnson et al., 2014, p. 28). The importance of rural education concerns is ever more prevalent today for the United States as rural area school population continues to outgrow urban areas.

One aspect of educational reform has been on narrowing the achievement gaps as demonstrated through subgroup reporting in accountability measurements, high-stakes testing, graduation rates, dropout rates, and standardized assessment. Johnson et al. (2014) suggested the dynamic changes in rural education demographics play a noteworthy role in this reform. Free- and reduced-lunch eligibility for rural students rose 5% from 2009 to 2011 and a 5% increase in minority students (Johnson et al., 2014). One high regional concentration identified in Johnson et al.’s (2014) study was the South. Mississippi ranked highest of all states on their study scale in needs of addressing rural education concerns compounded by high diversity rates of students identified in achievement gap concentrations (Johnson et al., 2014). The Education Week Research Center (2014) report targeted Mississippi as rating last in the K-12 Achievement index in the United States and the District of Columbia. This index is measured based on performance levels and growth in reading and math and achievement gaps in socioeconomic areas (The Education Week Research Center, 2014). In 2013, although the
United States was showing growth on the National Assessment of Educational Progress (NAEP) in Grades 4 and 8 in reading and math, Mississippi scored below the national average (U.S. Department of Education, 2013). These reports indicated a significant relationship in rural education public school populations in regard to student achievement. Therefore, it is necessary that student achievement growth be addressed as well as pinpoint gap indicators compounded by rural education concerns.

Research shows technology integration can play a pivotal role in student achievement gains regardless of school geographic areas (Cakir, Delialioglu, Dennis, & Duffy, 2009). Cakir et al. analyzed data from 386 high schools using student final examination scores on a blended environment of face-to-face and online instruction. The study results demonstrated “technology enhanced blended learning environments hold the promise of providing better and equal educational opportunities for all students” (p. 311). Some research supports positive results of technology integration effects on student achievement (Bebell & Kay, 2009; Dunleavy et al., 2007; Eyyam & Yaratan, 2014). However, consideration of technology access and integration continues to be a viable concern for all student populations. This consideration is most profoundly provoked for rural areas where resources and funding are associated barriers (Lu & Overbaugh, 2009; Plopper & Conaway, 2013; Sundeen & Sundeen, 2013). According to McCord & Ellerson’s (2009) survey study of school district superintendents the majority of districts indicated funding to be less than adequate where districts in rural areas reported underfunding at an 8% increase between 2008 and 2009. Lu and Overbaugh’s (2009) study reported levels of concerns for access to technology resources in Virginia rural schools. Although state and federal policy continues to strive to ensure technology access and connectivity throughout all schools, the same barriers in urban areas continue to affect rural
areas. However, prioritizing technology resources and accessibility in rural schools becomes even more arduous.

**Next-generation Assessments**

The Partnership for Assessment of College and Career Readiness (PARCC) and Smarter Balance Assessment consortia have developed next-generation assessments for implementation in the 2014-15 school year. The high-stakes technology medium administered assessments will measure students’ proficiency on CCSS through two summative tests measuring knowledge and performance. United States Secretary of Education Arnie Duncan (2010) applauds the consortia efforts for creating many firsts in the realm of educational assessment. The firsts include using technology, providing formative assessments, but most importantly, “new assessments will better measure the higher-order thinking skills so vital to success in the global economy of the 21st century and the future of American prosperity” (Duncan, 2010, para. 12). Duncan’s support suggested next-generation assessments as a means to ensure states are measuring content knowledge as well as skills sets needed to prosper beyond high school.

Webb’s (2002) depth of knowledge (DOK) construct describes cognitive learning levels at four different points. Depth of knowledge level one indicates lower mental processes where levels two and three significantly raise the process upon a continuum to a level 4 value where deeper and higher learning experiences are found. In a RAND research project, Yuan and Le’s (2012) used Webb’s DOK construct to analyze 17 states’ achievement test items’ rigor in measuring student higher learning. Yuan and Le’s research found very few deeper learning constructs in math and ELA state assessment items. Their findings estimated less than 10% of deeper learning items are used in state assessments for math, reading, and writing.
Herman and Linn’s (2013) analysis described current standardized test measuring based on Webb’s depth of knowledge construct at DOK 1-2 levels only. Herman and Linn suggested DOK 3 and 4 items are necessary (p. 5) to properly “reflect essential capabilities for 21st century competence.” According to Herman and Linn (2014), both Smarter Balance and PARCC assessments will encompass at least a third of level three or higher items in both math and ELA. Their review of PARCC and Smarter Balance assessment developments suggested these next-generation assessments are a step in the right direction.

These findings and suggestions indicate a need for change in current assessments where low-level items dominate measurement of content knowledge. To truly measure deeper levels of understanding and 21st century skills sets, Herman and Linn (2013) recommended assessments encompassing more high-order thinking items. These researchers summarized the National Center for Research on Evaluation, Standards, and Student Testing (CRESST) findings to provide insight to the development of the next-generation assessments. Herman and Linn’s (2013) summary gives some validity to the process and suggest both consortia, . . . summative assessments and students’ proficiency classifications based on the assessments will represent many goals for deeper learning, particularly those related to mastering and being able to apply core academic content and cognitive strategies related to complex thinking, communication, and problem solving. (p.17)

The next-generation assessment will redesign how and what is assessed in schools. These assessments will provide opportunities to measure all cognitive processes as well as content knowledge demonstrating 21st century skills.

Past research regarding technology’s role in assessment has shown positive evidence in measuring more complex cognitive processes. Quellmalz et al.’s (2013) study suggested interactive approaches to assessment in science practices better measure application as well as
knowledge when compared to more traditional practices. Quellmalz et al.’s findings suggested
more engaging and interactive assessment items better measure deeper cognitive processes.
Bebell and Kay’s (2009) in-depth study of students in a 1:1 laptop environment found
significantly higher scores and length of essays for students who took the writing assessment on
a computer versus students who completed the writing assessment using paper and pencil.
These results suggested there will be opportunities to better measure student achievement
through the technological mediums next-generation assessments are being administered.

Doorey (2012) suggested the first year of statewide next-generation implementation as
“not really the finish line, but only the first leg in a longer race to create next-generation
teaching, learning, and assessment systems that prepare all students . . . .” (p. 34). Doorey’s
(2012) suggestion that these next-generation assessments having such a profound impact on
teaching and learning revolves around the premise they will better measure deeper learning,
provide informative data, and continue to develop with technological advances and changing
demands of society. The next-generation assessments will play an essential role in the access
and use of technology in teaching and learning. Schools are steadily preparing for technology-
based assessment implementation. This implementation suggested the needs of school access
to technology and the pedagogical shifts needed to develop 21st century skills students will
have to demonstrate on the assessments (Achieve, Inc. et al., 2012; Gullen, 2014).

Summary

Technology has and will continue to have an important role in the pedagogical shifts
needed to meet the demands of CCSS and CCR benchmarks as measured by next-generation
assessments. Historical policies and traditional practices have stymied technology access and
integration, although there is recognition of technology value and support in federal and state
policies and programs with more current directives to address. Past researchers indicated a need to explore levels of technology integration’s impact on teaching and learning. There is also a need to examine new technology trends as influenced by the college and career-guided standards and assessments and exploring those trends for continuous growing in diverse rural populations. To truly prepare today’s student for tomorrow, the use of technology in teaching and learning is fundamental.
CHAPTER III

RESEARCH METHODS

The pertinent components of the study’s research design, including the population, sample and subjects, the instruments and protocols used, the procedures of the study, the research questions and hypotheses, and the statistical test and data analysis, are discussed in this section. Each section describes the specific research elements providing details of the methods used in conducting the study. The population, sample, and subjects section identifies the study participants and correlates the participants to the research sample and population. The instrument and protocol section provides details referencing the tools used to collect data throughout the study. The research procedure section describes the steps in administering the study including obtaining permission to conduct the study and data collection. The research questions and hypotheses section describes the study’s guiding inquiry design and specifies the hypothesis testing. The statistical test and data analysis section depicts the statistical models used to analyze the collected data.

Research Design

The mixed-methods study explored the influences of two different levels of technology access and integration influences on college and career readiness benchmarks for recent graduates. There are a variety of research strategies for mixed-method designs. Creswell (2009) described characteristics important in mixed-methods preliminary considerations, timing, weight, and mixing. Each feature builds a framing of the mixed-method procedures.
Timing refers to how the two types of data are collected, in a sequential order or simultaneously (Creswell, 2009). According to Creswell, referencing each data type’s level of power for analysis and interpretation refers to weight. Collected data can be analyzed and interpreted separately for comparison, merged together, or embedded (Creswell, 2009). The concurrent triangulation model for this mixed-methods study was used to simultaneously gather equally weighted quantitative and qualitative data and compare the results of each to interpret and expand the overall findings (Creswell, 2009; Creswell & Clark, 2007; Creswell & Clark, 2008). Both individual quantitative and qualitative data results are assimilated for interpretation. According to Creswell and Clark (2007), this model is a common approach for mixed-methods studies where “. . . authors will report a statistical result and then follow it up with specific quotes or information about them that confirms or disconfirms the quantitative results” (p. 140). The use of this mixed-methods data analysis strengthened the overall interpretation of the research findings.

The rationale for the mixed-method design is to explore the phenomenon beyond the independent quantitative and qualitative strategies to compare data for “convergence, differences or some combination” between independent findings (Creswell, 2009, p. 213). Therefore, both the quantitative and qualitative individual methods add value to overall results by “. . . a means to offset the weaknesses inherent within one method with the strength of the other (or conversely, the strength of one adds to the strength of the other)” (Creswell, 2009, p. 213).

A causal-comparative, quantitative approach is used to investigate a possible cause and effect relationship (Gall, Gall, & Borg, 2007; Gay, 1996). Characteristics of this type research include, retrospective analysis and the lack of random sampling processes as in the cause and
effect experience already occurred (Gay, 1996). Causal-comparative designs are used to “permit investigation of variables that cannot or should not be investigated experimentally, facilitate decision making, and provide guidance for experimental studies” (Gay, Mills, & Airasian, 2006, p. 220). This type of nonexperimental study is intentional because of ethical concerns of the research implementation involving educational related variables that are not manipulated (Gay, 1996). The use of a causal-comparative approach is most conducive for examining technology’s influence on CCR between two school districts in the same rural Mississippi county area as measured by the ACT® achievement test.

The qualitative strategy of the current study explored student, teacher, and administrative attitudes and perceptions of technology influences on student success beyond high school as well as current challenges and past cultural attitudes and priorities. The data was collected through focus groups, interviews, and documentation review between the same two school districts. Focus groups explored understandings of current student perceptions and mindsets toward technology access and integration experiences in high school correlated to first-year experiences in college or in the workplace. Interviews investigated teachers as well as building- and district-level administration perceptions and attitudes on technology integration impacts on CCR and challenges in ensuring equitable access and integration for technology for all students. Review of school board policy and board minutes provided details of past district priorities and educational culture in regard to technology access and integration.

Population, Sample and Subjects

This research study included a sample from the 2014 graduating classes from two different school districts who took the ACT® and continued beyond high school with an academic pathway or career. One group (District A) of the total sample represented a school
district where the 2014 cohort graduates experienced a 1:1 laptop learning environment for their four-year high school experience. The other group in the sample included representation of a school district (District B) where the 2014 cohort graduates participated in limited or shared access to computers throughout their four-year high school experience. The limited and shared technology access school district was comprised of three high schools. According to the district technology director (personal communication, November, 2014), each high school has approximately 90 to 110 computers available through three to four computer labs at each school site. The director described students’ access to the labs is through course specific classes, such as STEM or business and technology education and through independent or course-directed uses in the library or Career Center. He also explained a few classrooms at two of the sites have a four-desktop computer hub for student use. Student access and use of technology for learning experiences are limited through shared computer labs and/or hubs at all three high schools sites within the district.

The sample from District A was comprised of students who not only took the ACT®, but also participated in the high school 1:1 laptop initiative all four years. The sample from District B was comprised of students who not only took the ACT®, but also attended four years of high school with shared or limited computer access and integration teaching and learning environment. A calculation for the total sample for the causal-comparative study was approximately 250 to 300 for each research site totaling a 500 to 600 sample size.

The qualitative approach to the study included a focus group strategy. Groups were comprised with student graduate representatives from each school district who met the parameters of the quantitative approach and who were currently enrolled in an academic pathway or employed in the workforce. The approximate sample size was four to nine students.
for each group. District-level administration or building-level principals and teachers from each school district were interviewed independently with approximately four to seven representatives from each site.

Highlights in Table 1 specify each district’s demographic makeup for the 2013-14 school year:

Table 1

*Participating Mississippi School District Demographics and Technology Access and Integration Level in 2013-14 School Year*

<table>
<thead>
<tr>
<th>Tech level</th>
<th>School district</th>
<th>2014 district state level</th>
<th>2014 graduation rate %</th>
<th>Free and reduced lunch %</th>
<th>Asian %</th>
<th>Black %</th>
<th>Hispanic %</th>
<th>Native American %</th>
<th>White %</th>
</tr>
</thead>
<tbody>
<tr>
<td>1:1</td>
<td>A</td>
<td>B</td>
<td>79.0</td>
<td>61.18</td>
<td>2.09</td>
<td>50.13</td>
<td>4.44</td>
<td>.04</td>
<td>43.31</td>
</tr>
<tr>
<td>Limited</td>
<td>B</td>
<td>C</td>
<td>66.8</td>
<td>61.54</td>
<td>.60</td>
<td>26.65</td>
<td>1.84</td>
<td>.15</td>
<td>70.75</td>
</tr>
<tr>
<td>and Shared</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: Mississippi Department of Education (n.d.a; n.d.b).

One other important distinction between the two school districts revolved around financial data. According to the Mississippi Department of Education (n.d.a), District A’s estimated per-pupil expenditure was $9,793, and District B’s estimated per pupil expenditure was $8,282. There was a significant difference in per-pupil expenditures with District A
providing approximately $1,511 more per pupil than District B. District A gained more local funding at 45.08% of revenue sources whereas District B’s local funding was 29.00% (Mississippi Department of Education, n.d.a). Information in Tables 2 specify each participating school’s demographics drawn from most recent school year data reports.

Table 2

*School Demographics According to Participating Districts and Schools in Mississippi Expressed in Percentages*

<table>
<thead>
<tr>
<th>District and school</th>
<th>2014 district state label</th>
<th>2014 grad rate</th>
<th>2011-12 free and reduced lunch</th>
<th>Race</th>
<th>Sex</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Black</td>
<td>White</td>
</tr>
<tr>
<td>A, 1</td>
<td>A</td>
<td>79.4</td>
<td>51.0</td>
<td>47.0</td>
<td>47.0</td>
</tr>
<tr>
<td>B, 1</td>
<td>B</td>
<td>78.4</td>
<td>47.0</td>
<td>6.0</td>
<td>92.0</td>
</tr>
<tr>
<td>B, 2</td>
<td>A</td>
<td>75.7</td>
<td>44.0</td>
<td>11.0</td>
<td>87.0</td>
</tr>
<tr>
<td>B, 3</td>
<td>D</td>
<td>52.2</td>
<td>81.0</td>
<td>72.0</td>
<td>26.0</td>
</tr>
</tbody>
</table>


Although the aggregated data for each district provided a demographic snapshot, it is important to recognize the independent makeup of each participating school. Specific demographic discrepancies were apparent among all schools. These discrepancies were most prevalent between socioeconomic status (SES) as indicated by free- and reduced-lunch (FRL)
eligibilities and race. The indicator for student sex was generally consistent across all four participating schools.

According to the U.S. Department of Education (2012b), free- and reduced-eligibility “is determined by household size and income or through categorical eligibility” (p. 2). Students who are in a household “at or below 130 percent of federal poverty guidelines are eligible for free meals” whereas students who are in households, “with income between 130 and 185 percent of the federal poverty guidelines are eligible for reduce-price meals” (p.2).

According to the Mississippi Department of Education (n.d.b), race subgroups for Asian, Hispanic, Native American, and multi-racial were not reported in school demographics to eliminate possible individual identifications. Therefore, only the black and white race percentages were reported.

Although SES and race indicators were not specific variables examined within this study, acknowledging the differences of the participating schools was needed to address limitations of the research study when drawing inferences on the results.

**Research Instruments and Protocols**

**ACT**

The ACT® is an achievement test for measuring content knowledge as well as assessing students on CCR standards (ACT, Inc., 2014d). The assessment program measures four content areas (English, math, reading, and science) providing individual scores and an overall composite score. According to ACT, Inc. (2014e), their achievement tests “are designed to determine how skillfully students solve problems, grasp implied meanings, draw inferences, evaluate ideas, and make judgments in subject-matter areas important to success in college” (p. 3). ACT’s College and Career Readiness standards represent what students know and are able
to do and fall within the idea that readiness for college and career are equated based on the premise that the same level of knowledge and skill level are needed for success in either area (ACT, Inc., 2006b). ACT, Inc. (2014d) provided college readiness benchmark scores to guide and inform student probability of success at college-level courses. These benchmark levels suggest students to have a “50% chance of obtaining a B or higher or about a 75% chance of obtaining a C or higher in corresponding credit-bearing first-year college courses” (ACT, Inc., 2014d, p. 19). These benchmark scores can be used as a guide for student success in experiences in college and career. Table 3 provides the college readiness benchmark scores for tested areas with the corresponding college courses identified:

Table 3

ACT® College Readiness Benchmark Scores and Corresponding College Courses

<table>
<thead>
<tr>
<th>Tested content area</th>
<th>College readiness benchmark</th>
<th>Corresponding college course</th>
</tr>
</thead>
<tbody>
<tr>
<td>English</td>
<td>18</td>
<td>English Composition</td>
</tr>
<tr>
<td>Reading</td>
<td>22</td>
<td>Social Sciences</td>
</tr>
<tr>
<td>Math</td>
<td>22</td>
<td>College Algebra</td>
</tr>
<tr>
<td>Science</td>
<td>23</td>
<td>Biology</td>
</tr>
</tbody>
</table>

Source: ACT, Inc., 2014d.

The ACT® assessment programs go through rigorous item development, robust evaluations and revisions, and validity and reliability testing (ACT, Inc., 2014e). According to
ACT, Inc. (2006a), the assessment programs have been a valued and trusted testing system for over 47 years.

The ACT® is usually given to students in 11th or 12th grade. According to the Mississippi Department of Education (2012), as of the 2014-15 school year, the ACT® was administered to all students in the 11th grade across the state. This progressive expectation demonstrates confidence and respect for the ACT® assessment program. ACT, Inc. (2006a) suggests the adoption of statewide ACT® administration is in response to educational focus on college and career readiness.

**Focus Group**

In qualitative research, focus groups are used to collect data generated by interactions and discussions of participants on a research topic (Gall et al., 2007). According to Morgan (1988), the interaction of the focus group interview is significant because it draws data “that would be less accessible without the interaction found in the group” (p. 12). Therefore, the process of group interaction during dynamic discussion is valuable qualitative data. For the purpose of this study, focus groups were conducted in the beginning processes of data collection. This process was used to initiate group discussion around student perceptions and attitudes toward technology experiences in high school. This dialog was linked with first-semester experiences in college and/or the workplace. The guiding questions for the focus groups were developed and validated through a pilot study. The pilot study incorporated four to six 18- to 20-year-old college or workforce representatives. The pilot study ensures question constructs are valid and provide answer thresholds for descriptive respondent conversation.
**Interviews**

According to Gay et al. (2006), interviews provide opportunities for more in-depth responses allowing better understanding of the interviewee’s perspective about a specific phenomenon. For the purpose of this study, interviews stimulated conversation about current instructional practices using technology, implications for future practices, and administrative challenges for ensuring equitable technology access and integration. Interviews were conducted with the principals or assistant principals of the high schools in both districts and the superintendents or assistant superintendents of each school district. Interviews were also conducted with teachers from the participating schools. The interviews focused on exploring current levels of technology access and integration, impacts on CCR, and priorities for future implications of technology access and integration for teaching and learning.

**Documentation Review**

District board policies, school board minutes, and budgetary information concerning technology initiatives were explored to find patterns impacting each school district’s culture toward technology access and integration. According to Gall et al. (2007), written documents provide evidence of “human environments” as recorded by people. This data collection process is fundamental when the events of the research study are in the past. The review of written documentation in reference to technology concerns provided insights to the school cultural perspective during the four-year period of the cohort sample studied.

**Research Procedures**

This study implemented a variety of strategies in examining technology’s role in the proficiencies of college and career readiness knowledge and skills. Preliminary efforts were made to ensure compliance with human subjects’ research such as obtaining approval from the
Institutional Review Board (IRB) at the University of Mississippi (see Appendix A). Since the study encompassed public school student data, approval from each school district was obtained prior to any testing endeavors (see Appendix B).

Once approval was obtained, data collection occurred concurrently for both the quantitative and qualitative aspects. For the causal-comparative study, the sample was examined to ensure participants met all criteria for inclusion for each district group. District A students participated in a 1:1 experience all four years of high school and have taken the ACT®. District B participants attended a district high school with limited or shared access to computers for all four years of high school and taken the ACT®. Once the sample was identified, data collection and statistical testing ensued.

The qualitative aspect began with a pilot study for the focus group to ensure question validity construct. Administration of the pilot study commenced during January of 2015. Once the questions were reviewed and edited, participants were contacted by email or telephone and invited to participate in the focus group discussion representing each school district. Focus group meetings took place where data were collected, video-recorded, transcribed, and analyzed. Building administration and teacher interviews took place concurrently with other data collection strategies. Each interview was audio-recorded, transcribed, and analyzed. District documentation was collected and reviewed simultaneously with other qualitative approaches.

**Research Questions and Research Hypotheses**

**Research Questions**

1. How do different levels of technology access and integration in high school learning
experiences impact student readiness for academic and career experiences beyond high school?

2. Is there a significant difference in mean composite score on the ACT® college readiness assessment between graduates in different levels of technology access and integration during a four-year high school experience?

3. Is there a significant difference in mean score in English on the ACT® college readiness assessment between graduates in different levels of technology access and integration during a four-year high school experience?

4. Is there a significant difference in mean score in reading on the ACT® college readiness assessment between graduates in different levels of technology access and integration during a four-year high school experience?

5. Is there a significant difference in mean score in math on the ACT® college readiness assessment between graduates in different levels of technology access and integration during a four-year high school experience?

6. Is there a significant difference in mean score in science on the ACT® college readiness assessment between graduates in different levels of technology access and integration during a four-year high school experience?

7. Is there a significant difference in mean score in reading on the ACT® college readiness assessment between graduates in different levels of technology access and integration during a four-year high school experience?

**Research Hypotheses**

1. There is no significant difference in 2014 graduate cohort student achievement based on mean composite score on the ACT® college readiness assessment for graduates in a 1:1 technology access and integration four-year high school experience compared to graduates in a limited or shared technology access and integration four-year high school experience.
2. There is no significant difference in 2014 graduate cohort student achievement based on mean score in English on the ACT® college readiness assessment between graduates in a 1:1 technology access and integration four-year high school experience compared to graduates in a limited or shared technology access and integration four-year high school experience.

3. There is no significant difference in 2014 graduate cohort student achievement based on mean score in reading on the ACT® college readiness assessment between graduates in a 1:1 technology access and integration four-year high school experience compared to graduates in a limited or shared technology access and integration four-year high school experience.

4. There is no significant difference in 2014 graduate cohort student achievement based on mean score in math on the ACT® college readiness assessment between graduates in a 1:1 technology access and integration four-year high school experience compared to graduates in a limited or shared technology access and integration four-year high school experience.

5. There is no significant difference in 2014 graduate cohort student achievement based on mean score in science on the ACT® college readiness assessment between graduates in a 1:1 technology access and integration four-year high school experience compared to graduates in a limited or shared technology access and integration four-year high school experience.

**Statistical Test and Data Analysis**

An independent t test was the statistical procedure used to test each hypothesis for mean differences. According to Gall et al. (2007), “a t distribution is used to determine the level of
statistical significance of an observed difference between sample means” (p. 139). This study examined the causal relationship between two groups of an independent variable on the dependent variable. In the independent $t$-test procedure for hypotheses one through five, there were two levels of the independent variable, technology access and integration: 1:1 and limited or shared. The dependent variable was the ACT® mean composite (H1) score or ACT® content specific mean score (H2-H5).

In support of the sample size, an a priori analysis was generated using G*Power 3.1 for a two-way $t$-test statistical process. Using an alpha level of .05, a small or moderate effect size of .25 and a power of .80, a total sample size of 506 was generated with each group having a 253 individual group sample. Therefore, the approximated 500 to 600 total sample size was substantiated in the research study.

**Summary**

This research study sought to provide useful information in understanding technology’s influence on current college and career readiness measurements as well as determining students’ attitudes and perceptions on those influences. This chapter outlined the mixed-methods design where the quantitative and qualitative data collection was concurrent, weight analysis was equal, and results were reported together. Two cohorts of 2014 school graduates with distinctly different technology access and integration experiences in high school represented the participants of the study. The ACT® achievement test was used as the quantitative instrument from which data were collected. Focus groups, interviews, and written documentation were used as the qualitative strategies for collecting data. The research procedures included preliminary study processes, obtaining appropriate permissions,
development of instruments, and merging of data for analysis. The study’s position of inquiry revolved around students’ technology access and integration in high school experiences’ influence on CCR. There were five hypotheses tested by an independent \( t \) test to determine significant differences in technology access and integration and CCR measurements. Both quantitative and qualitative data results were analyzed independently and combined for interpretation. The framework of the study provided the structure to implement relevant research valuable in the field of education.
CHAPTER IV
RESEARCH FINDINGS

This mixed-method research study explored the influences of technology access and integration on college and career readiness in two rural North Mississippi school districts located in the same county. The research study embodies a twofold approach incorporating an equally weighted concurrent quantitative and qualitative approach to respond to five hypotheses and six research questions. Chapter IV describes the research findings for each mixed-method process by reporting quantitative and qualitative results. The quantitative approach examined a statistical comparison between a sample of each district representing two different levels of technology access and integration on ACT® mean scores for English, math, science, reading, and composite. The qualitative approach explored perceptions and attitudes of technology’s impact on college and career readiness through a triangulation of data findings from document reviews, interviews, and focus group meetings represented by both school districts. The mixed-method study research findings were divided in two sections representing the quantitative and qualitative methods.

Quantitative Research Findings

Population and Sample

The quantitative sample was generated through a nonprobability process by purposively identifying specific criteria for inclusion from two rural North Mississippi school districts residing in the same county. The total sample was comprised of representatives from District A and District B. District A represents a school district with one high school offering a 1:1 laptop

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program; whereas, District B represents a school district with three high schools with a shared-based technology learning environment. Participants included in the District A sample (a) attended the school district’s high school for four years from 2010 through 2014, (b) participated in the 1:1 laptop program for all four years, and (c) had ACT® scores for English, math, science, reading, and total composite reported back to the school district. District B’s sample was comprised of participants who (a) attended high school between 2010 and 2014 at one of the school district’s high schools and (b) reported ACT® scores for English, math, science, reading, and total composite back to the school district.

The population pool for District A was drawn from a computer software query within the school district’s student information system. The query provided a population of 2014 graduates ($n = 338$) who attended the high school for all four years between 2010 and 2014. Using archived fixed-asset records, participant eliminations were made based on documentation indicating lack of student participation in the 1:1 laptop program. Thirty students were dismissed from the population based on laptop check in and check out date records reviewed for each of the four school years developing a sample size of 308. ACT® reporting scores were collected from the district as the graduates’ last known reported score for the composite and relevant subscores. Twenty-two students of this population did not have ACT® scores reported for English, math, reading, science, and composite. These participants were removed from the population leaving a total sample size for District A at 286. The population pool for District B was drawn from a computer software query within the school district’s student information system. The query provided a population of 2014 graduates ($n = 316$) who attended one of the three high schools for all four years between 2010 and 2014. High school B1 had 79 graduates, high school B2 had 152 graduates, and high school B3 had
85 graduates. ACT® reporting scores were collected from the district as the graduates’ last known reported score for the composite and relevant subscores. Forty-four students of this population did not have reporting ACT scores for English, math, reading, science, and composite. These participants were eliminated from the population, leaving a finalized sample size for District B at 272. The total sample size for the study was 558. Sample participation for each district required identifying markers for criteria inclusion review. Once the sample was finalized for each district, the data were de-identified and prepared for SPSS input and ensuing statistical analysis. For the purpose of the study’s reported findings, any names used are pseudonyms to protect participant confidentiality.

Table 4 provides population and sample figures from each district and schools within the district with a total sample of 558 for the study. Table 4 represents the following:

**Table 4**

*Population and Sample According to District and School*

<table>
<thead>
<tr>
<th>District/School</th>
<th>Population</th>
<th>n</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1</td>
<td>338</td>
<td>286</td>
</tr>
<tr>
<td>B1</td>
<td>79</td>
<td>71</td>
</tr>
<tr>
<td>B2</td>
<td>152</td>
<td>135</td>
</tr>
<tr>
<td>B3</td>
<td>85</td>
<td>66</td>
</tr>
<tr>
<td>Total</td>
<td>654</td>
<td>558</td>
</tr>
</tbody>
</table>
Statistical Analysis

Each of the five hypotheses was tested by an independent sample $t$ test measuring for a significant difference between mean scores of the two sample groups. Several assumptions were met to validate the use of an independent $t$ test including the following: (a) sample independence or assurance the samples were unrelated, (b) normal distribution of sample scores, and (c) homogeneity of variance (Gall et al., 2007; Hinkle, Jurs & Wiersma, 2003). For each of the hypotheses, descriptive statistics, assumptions testing, and inferential statistics were reported. Descriptive statistics information reports group mean ($M$), standard deviation ($SD$), and standard error mean ($SDE$) as well as skewness. The district and the type of participants in the respective districts identify each group (District A: 1:1; District B: Shared). The total sample size for each group is represented by $N$.

Researchers have documented the $t$ test as a “robust” parametric measure where a minor violation of normality in large sample sizes does not necessarily constitute invalid test results (Hinkle et al., 2003; Morgan, Leech, Gloeckner, & Barrett, 2013; Pagano, 2012;). According to Morgan et al. (2013), “. . . the standard error depends on the sample size, so with large samples most variables would be found to be non-normal, yet actually, data for large samples are more likely to be approximately normal” (“Statistical Assumptions,” para 16). Thus, Morgan et al. (2013) suggested reviewing the skewness descriptive and evaluating an approximate normality based on the absolute value being $< 1$. If the skewness descriptive was $< 1$ based on its absolute value, the assumption of approximate normality was inferred. Therefore, the normality assumption in this study was gauged and reported by this criterion.

According to Hinkle et al., (2003) sample independence relies heavily on random sampling. It is suggested the most appropriate way to ensure independence is to administer a
random sampling technique from the population (Hinkle et al., 2003). According to Gall et al. (2007), if convenience sampling is used with inferential statistics, it is imperative to provide detailed sample descriptions to help provide a framework for making generalizations to the population. To validate the use of inferential statistics to support generalization, Gall et al. (2007) suggested the sample should be “…carefully conceptualized to represent a particular population” (p. 176). Therefore, a detailed informative description of this study’s sampling procedures was provided in the previous section warranting observance of the assumption of independence for all hypotheses.

**Research hypotheses.** Each of the following hypotheses was tested in the research study by an independent sample $t$ test measuring for a significant difference between mean scores of the two sample groups.

**Hypothesis one.** Hypothesis one stated there is no significant difference in 2014 graduate cohort student achievement based on mean composite score on the ACT® college readiness assessment for graduates in a 1:1 technology access and integration four-year high school experience compared to graduates in a limited or shared technology access and integration four-year high school experience. This hypothesis was tested using an independent $t$ test to examine mean differences between the samples.

Table 5 indicates for descriptive data for the ACT® composite scores for the two groups. The subsample for District A was 286 and 272 for District B. The assumption of normality was met based on the skewness descriptive for District A (.422 < 1) and District B (.761 < 1). Achievement on the ACT® composite was greater for District A ($M = 20.78$, $SD = 5.063$) than District B ($M = 19.88$, $SD = 4.621$).
Table 5

Descriptive Statistics for ACT® Composite Score for Two Groups

<table>
<thead>
<tr>
<th>District</th>
<th>N</th>
<th>M</th>
<th>SD</th>
<th>SDE</th>
<th>Skewness</th>
</tr>
</thead>
<tbody>
<tr>
<td>A (1:1)</td>
<td>286</td>
<td>20.78</td>
<td>5.063</td>
<td>.299</td>
<td>.422</td>
</tr>
<tr>
<td>B (Shared)</td>
<td>272</td>
<td>19.88</td>
<td>4.621</td>
<td>.280</td>
<td>.761</td>
</tr>
</tbody>
</table>

Note. N = sample size; M = mean; SD = standard deviation; SDE = standard deviation error mean.

Table 6 represents the independent $t$ test results including the Levene’s test for homogeneity of variance. Table 6 states the following:

Table 6

Independent $t$-Test Results for ACT® Composite Score

<table>
<thead>
<tr>
<th></th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>F</td>
</tr>
<tr>
<td>Equal variances assumed</td>
<td>4.760</td>
</tr>
<tr>
<td>Equal variances not assumed</td>
<td>2.189</td>
</tr>
</tbody>
</table>

Note. $F = F$ distribution; Sig = significance level of Levene’s test; $t = t$ statistic; $df = degrees of freedom$; Sig (2-tailed) = $t$ test significance level; $MD = mean difference$; $(SDE) = standard error difference$; CI = confidence interval; LL = lower limit; UL = higher limit.
The results of Levene’s test for equality of variances indicated a violation for the assumption of homogeneity of variance ($p = .030$). Therefore, the District A mean ACT® composite score was .89, 95% CI [0.09 to 1.70] higher than the District B mean ACT® composite score. The difference was statistically significant in mean ACT® composite score between District A and District B, $t(555.067) = 2.189$, $p = .029$. The $p$ value of .029 was less than the significant value of .05; therefore, the null hypothesis was rejected. There is a significant difference in 2014 graduate cohort student achievement based on mean composite scores on the ACT® college readiness assessment between graduates in a 1:1 technology access and integration four-year high school experience compared to graduates in a limited or shared technology access and integration four-year high school experience.

**Hypothesis two.** Hypothesis two states there is no significant difference in 2014 graduate cohort student achievement based on mean score in English on the ACT® college readiness assessment between graduates in a 1:1 technology access and integration four-year high school experience compared to graduates in a limited or shared technology access and integration four-year high school experience.

Table 7 indicates the descriptive data for the ACT® English scores for the two groups. The assumption of normality is met based on the skewness descriptive for District A (.354 < 1) and District B (.533 < 1). Achievement on the ACT® English was greater for District A ($M = 21.23$, $SD = 6.768$) than District B ($M = 19.68$, $SD = 5.918$).
Table 7

Descriptive Statistics for ACT® English Score for Two Groups

<table>
<thead>
<tr>
<th>District</th>
<th>n</th>
<th>M</th>
<th>SD</th>
<th>SDE</th>
<th>Skewness</th>
</tr>
</thead>
<tbody>
<tr>
<td>A (1:1)</td>
<td>286</td>
<td>21.23</td>
<td>6.768</td>
<td>.400</td>
<td>.354</td>
</tr>
<tr>
<td>B (Shared)</td>
<td>272</td>
<td>19.68</td>
<td>5.918</td>
<td>.359</td>
<td>.533</td>
</tr>
</tbody>
</table>

Note. N = sample size; M = mean; SD = standard deviation; SDE = standard deviation error mean.

Table 8 represents the independent t test results including Levene’s test for homogeneity of variance. Table 8 indicates the following:

Table 8

Independent t Test Results for ACT® English Score

<table>
<thead>
<tr>
<th></th>
<th>95% CI</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>F</td>
<td>Sig</td>
<td>t</td>
<td>df</td>
<td>MD</td>
<td>(SDE)</td>
</tr>
<tr>
<td>Equal variances</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>assumed</td>
<td>6.807</td>
<td>.009</td>
<td>2.868</td>
<td>556.00</td>
<td>.004</td>
<td>1.547</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(SDE)</td>
<td></td>
<td></td>
<td></td>
<td>(.539)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>LL</td>
<td></td>
<td></td>
<td>.488</td>
<td>UL</td>
</tr>
<tr>
<td></td>
<td></td>
<td>UL</td>
<td></td>
<td></td>
<td>2.606</td>
<td></td>
</tr>
<tr>
<td>Equal variances</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>not assumed</td>
<td>2.878</td>
<td>552.146</td>
<td>.004</td>
<td></td>
<td>1.547</td>
<td>(.538)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(SDE)</td>
<td></td>
<td></td>
<td>.491</td>
<td>UL</td>
</tr>
<tr>
<td></td>
<td></td>
<td>LL</td>
<td></td>
<td></td>
<td>2.603</td>
<td></td>
</tr>
</tbody>
</table>

Note. F = F distribution; Sig = significance level of Levene’s test; t = t statistic; df = degrees of freedom; Sig (2-tailed) = t test significance level; MD = mean difference; (SDE) = standard error difference; CI = confidence interval; LL = lower limit; UL = higher limit.
The results of Levene’s test for equality of variances indicate a violation for the assumption of homogeneity of variance ($p = .009$). Therefore, the District A mean ACT® English score was 1.55, 95% CI [.49 to 2.60] higher than the District B mean ACT® English score. The difference was statistically significant in mean ACT® English score between District A and District B, $t(552.146) = 2.878$, $p = .004$. The $p$ value of .004 was less than the significant value of .05; therefore, the null hypothesis was rejected. There is a significant difference in 2014 graduate cohort student achievement based on mean English scores on the ACT® college readiness assessment between graduates in a 1:1 technology access and integration four-year high school experience compared to graduates in a limited or shared technology access and integration four-year high school experience.

**Hypothesis three.** Hypothesis three stated there is no significant difference in 2014 graduate cohort student achievement based on mean score in reading on the ACT® college readiness assessment between graduates in a 1:1 technology access and integration four-year high school experience compared to graduates in a limited or shared technology access and integration four-year high school experience.

Table 9 indicates the descriptive data for the ACT® reading scores for the two groups. The assumption of normality was met based on the skewness descriptive for District A (.345 < 1) and District B (.629 < 1). Achievement on the ACT® reading was greater for District A ($M = 21.22$, $SD = 5.983$) than District B ($M = 20.19$, $SD = 5.432$).
### Table 9

**Descriptive Statistics for ACT® Reading Score for Two Groups**

<table>
<thead>
<tr>
<th>District</th>
<th>N</th>
<th>M</th>
<th>SD</th>
<th>SDE</th>
<th>Skewness</th>
</tr>
</thead>
<tbody>
<tr>
<td>A (1:1)</td>
<td>286</td>
<td>21.22</td>
<td>5.983</td>
<td>.354</td>
<td>.345</td>
</tr>
<tr>
<td>B (Shared)</td>
<td>272</td>
<td>20.19</td>
<td>5.432</td>
<td>.329</td>
<td>.629</td>
</tr>
</tbody>
</table>

*Note. N = sample size; M = mean; SD = standard deviation; SDE = standard deviation error mean.*

Table 10 represents the independent $t$ test results including the Levene’s test for homogeneity of variance. Table 10 states the following:

### Table 10

**Independent $t$ Test Results for ACT® Reading Score**

<table>
<thead>
<tr>
<th></th>
<th>Sig</th>
<th>$t$</th>
<th>df</th>
<th>Sig (2-tailed)</th>
<th>MD (SDE)</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Equal variances</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>assumed</td>
<td>.067</td>
<td>2.132</td>
<td>556.00</td>
<td>.033</td>
<td>1.033</td>
<td>(.485) (.081, 1.984)</td>
</tr>
<tr>
<td>Equal variances</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>not assumed</td>
<td>.033</td>
<td>2.137</td>
<td>554.813</td>
<td>.033</td>
<td>1.033</td>
<td>(.483) (.083, 1.982)</td>
</tr>
</tbody>
</table>

*Note. F = F distribution; Sig = significance level of Levene’s test; $t = t$ statistic; df = degrees of freedom; Sig (2-tailed) = $t$ test significance level; MD = mean difference; (SDE) = standard error difference; CI = confidence interval; LL = lower limit; UL = higher limit.*
Levene’s test for equality of variances indicated the homogeneity of variance assumption as being met ($p = .067$). The District A mean ACT® reading score was 1.03, 95% CI [.08 to 1.98] higher than the District B mean ACT® reading score. The difference is statistically significant in mean ACT® reading score between District A and District B, $t(556) = 2.132, p = .033, d = .18$. The $p$ value of .033 is less than the significant value of .05; therefore, the null hypothesis was rejected. There is a significant difference in 2014 graduate cohort student achievement based on mean reading scores on the ACT® college readiness assessment between graduates in a 1:1 technology access and integration four-year high school experience compared to graduates in a limited or shared technology access and integration four-year high school experience.

**Hypothesis four.** Hypothesis four stated there is no significant difference in 2014 graduate cohort student achievement based on mean score in math on the ACT® college readiness assessment between graduates in a 1:1 technology access and integration four-year high school experience compared to graduates in a limited or shared technology access and integration four-year high school experience.

Table 11 indicates the descriptive data for the ACT® math scores for the two groups. The assumption of normality was met based on the skewness descriptive for District A ($.671 < 1$). The approximated normality for District B ($1.106 > 1$) is in violation. Achievement on the ACT® math was greater for District A ($M = 19.80, SD = 4.643$) than for District B ($M = 19.47, SD = 4.465$).
Table 11

Descriptive Statistics for ACT® Math Score for Two Groups

<table>
<thead>
<tr>
<th>District</th>
<th>N</th>
<th>M</th>
<th>SD</th>
<th>SDE</th>
<th>Skewness</th>
</tr>
</thead>
<tbody>
<tr>
<td>A (1:1)</td>
<td>286</td>
<td>19.80</td>
<td>4.643</td>
<td>.275</td>
<td>.671</td>
</tr>
<tr>
<td>B (Shared)</td>
<td>272</td>
<td>19.47</td>
<td>4.465</td>
<td>.271</td>
<td>1.106</td>
</tr>
</tbody>
</table>

Note.  N = sample size; M = mean; SD = standard deviation; SDE = standard deviation error mean.

Table 12 indicates the independent t test results including Levene’s test for homogeneity of variance. Table 12 indicates the following:

Table 12

Independent t Test Results for ACT® Math Score

<table>
<thead>
<tr>
<th>95% CI</th>
<th>F</th>
<th>Sig</th>
<th>t</th>
<th>df</th>
<th>Sig (2-tailed)</th>
<th>MD (SDE)</th>
<th>LL</th>
<th>UL</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Equal variances assumed 2.378 .124 .837 556.00 .403 .323 (.386) -.435 1.801

Equal variances not assumed .837 555.930 .403 (.386) -.434 1.080

Note.  F = F distribution; Sig = significance level of Levene’s test; t = t statistic; df = degrees of freedom; Sig (2-tailed) = t test significance level; MD = mean difference; (SDE) = standard error difference; CI = confidence interval; LL = lower limit; UL = higher limit.

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The results of Levene’s test for equality of variances indicated the assumption of homogeneity of variance as met \((p = .124)\). The District A mean ACT® math score was .32, 95% CI [-.435 to 1.08] higher than the District B mean ACT® math score. The difference was not statistically significant in mean ACT® math score between District A and District B, \(t(556) = .837, p = .403\). The \(p\) value of .403 was greater than the significant value of .05, therefore, failed to reject the null hypothesis.

According to the descriptive data found in Table 14, the sample for District B demonstrates a significant violation of approximate normality \((1.106 > 1)\). Therefore, the original data were transformed using the square-root application for a “moderately, positively skewed” sample (Laerd Statistics, 2013). The findings were reported in a sensitivity analysis to confirm original data findings (Laerd Statistics, 2013). Table 13 indicates the descriptive data for the transformed ACT® math scores for the two groups. Table 13 states the following:

Table 13

<table>
<thead>
<tr>
<th>District</th>
<th>(N)</th>
<th>(M)</th>
<th>(SD)</th>
<th>(SDE)</th>
<th>Skewness</th>
</tr>
</thead>
<tbody>
<tr>
<td>A (1:1)</td>
<td>286</td>
<td>4.42</td>
<td>.510</td>
<td>.030</td>
<td>.144</td>
</tr>
<tr>
<td>B (Shared)</td>
<td>272</td>
<td>4.38</td>
<td>.484</td>
<td>.029</td>
<td>.148</td>
</tr>
</tbody>
</table>

*Note. \(N = \text{sample size} ; M = \text{mean} ; SD = \text{standard deviation} ; SDE = \text{standard deviation error mean.}***
The assumption of normality was met based on the skewness descriptive for District A (.144 < 1) and District B (.148 < 1). Achievement on the ACT® math was greater for District A (M = 4.42, SD = .510) than for District B (M = 4.38, SD = .484).

Table 14 represents the independent t test results including Levene’s test for homogeneity of variance. Table 14 states the following:

Table 14
Independent t Test Results for Transformed ACT® Math Score

<table>
<thead>
<tr>
<th></th>
<th>F</th>
<th>Sig</th>
<th>t</th>
<th>df</th>
<th>Sig (2-tailed)</th>
<th>MD</th>
<th>(SDE)</th>
<th>LL</th>
<th>UL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Equal variances assumed</td>
<td>3.040</td>
<td>.082</td>
<td>.801</td>
<td>556.00</td>
<td>.424</td>
<td>.034</td>
<td>(.042)</td>
<td>-.049</td>
<td>.116</td>
</tr>
<tr>
<td>Equal variances not assumed</td>
<td>.802</td>
<td>555.998</td>
<td>.423</td>
<td>.034</td>
<td>(.042)</td>
<td>-.048</td>
<td>.116</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note. F = F distribution; Sig = significance level of Levene’s test; t = t statistic; df = degrees of freedom; Sig (2-tailed) = t test significance level; MD = mean difference; (SDE) = standard error difference; CI = confidence interval; LL = lower limit; UL = higher limit.

The results of Levene’s test for equality of variances indicated the assumption of homogeneity of variance as met (p = .082). The District A mean ACT® math score was .034, 95% CI [-.049 to -.116] higher than the District B mean ACT® math score. The difference is not statistically significant in mean ACT® math score between District A and District B, t(556) = .801, p =
The $p$ value of .424 was greater than the significant value of .05, therefore, failed to reject the null hypothesis. Therefore, the original data $t$ test findings were confirmed. There is no significant difference in 2014 graduate cohort student achievement based on mean math scores on the \textit{ACT}® college readiness assessment between graduates in a 1:1 technology access and integration four-year high school experience compared to graduates in a limited or shared technology access and integration four-year high school experience.

\textit{Hypothesis five.} Hypothesis five stated there is no significant difference in 2014 graduate cohort student achievement based on mean score in science on the \textit{ACT}® college readiness assessment between graduates in a 1:1 technology access and integration four-year high school experience compared to graduates in a limited or shared technology access and integration four-year high school experience.

Table 15 indicates the descriptive data for the \textit{ACT}® science scores for the two groups. Table 15 states the following:

\textit{Table 15}

\textit{Descriptive Statistics for \textit{ACT}® Science Score for Two Groups}

<table>
<thead>
<tr>
<th>District</th>
<th>$N$</th>
<th>$M$</th>
<th>$SD$</th>
<th>$SDE$</th>
<th>Skewness</th>
</tr>
</thead>
<tbody>
<tr>
<td>A (1:1)</td>
<td>286</td>
<td>20.41</td>
<td>4.896</td>
<td>.289</td>
<td>.287</td>
</tr>
<tr>
<td>B (Shared)</td>
<td>272</td>
<td>19.59</td>
<td>4.711</td>
<td>.286</td>
<td>.330</td>
</tr>
</tbody>
</table>

\textit{Note.} $N = \text{sample size}; M = \text{mean}; SD = \text{standard deviation}; SDE = \text{standard deviation error mean}.$
The assumption of normality was met based on the skewness descriptive for District A (.287 < 1) and District B (.330 < 1). Achievement on the ACT® science was greater for District A ($M = 20.41, SD = 4.896$) than District B ($M = 19.59, SD = 4.711$).

Table 16 represents the independent $t$ test results including Levene’s test for homogeneity of variance. Table 16 states the following:

Table 16

*Independent $t$ Test Results for ACT® Science Score*

<table>
<thead>
<tr>
<th></th>
<th>$F$</th>
<th>Sig</th>
<th>$t$</th>
<th>df</th>
<th>Sig (2-tailed)</th>
<th>MD (SDE)</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Equal variances assumed</td>
<td>1.213</td>
<td>.271</td>
<td>2.016</td>
<td>556.00</td>
<td>.044</td>
<td>.821 (.407)</td>
<td>.021 to 1.62</td>
</tr>
<tr>
<td>Equal variances not assumed</td>
<td>2.018</td>
<td>555.923</td>
<td>.044</td>
<td></td>
<td>.821 (.407)</td>
<td>.022 to 1.62</td>
<td></td>
</tr>
</tbody>
</table>

*Note.* $F = F$ distribution; Sig = significance level of Levene’s test; $t = t$ statistic; df = degrees of freedom; Sig (2-tailed) = $t$ test significance level; MD = mean difference; (SDE) = standard error difference; CI = confidence interval; LL = lower limit; UL = higher limit.

The results of Levene’s test for equality of variances indicated the assumption of homogeneity of variance was met ($p = .271$). The District A mean ACT® science score was .82, 95% CI [.02 to 1.62] higher than the District B mean ACT® science score. The difference was statistically significant in mean ACT® science score between District A and District B, $t(556) = 2.016, p =$
.044, \( d = .17 \). The \( p \) value of .044 was less than the significant value of .05; therefore, the null hypothesis was rejected. There is significant difference in 2014 graduate cohort student achievement based on mean science scores on the ACT® college readiness assessment between graduates in a 1:1 technology access and integration four-year high school experience compared to graduates in a limited or shared technology access and integration four-year high school experience.

**Qualitative Research Findings**

The qualitative aspect of the study explored perspectives and attitudes as extracted from document reviews, interviews, and focus group meetings to triangulate data in answering the overarching guiding research question and consequent questions related to the quantitative inquiry. The guiding research question posed was as follows: How do different levels of technology access and integration in high school learning experiences impact student readiness for academic and career experiences beyond high school?

**Population, Sample and Setting**

All the sample participants of the research study were identified through nonprobability sampling techniques to ensure opportunities for exploration depth of the research questions. According to Creswell and Clark (2008), nonprobability sampling was synonymous with purposeful sampling where there is a lack of a random sample because the intent of the sample was to “achieve representativeness or comparability” (p. 203). Palinkas et al. (2013) claimed that, “Purposeful sampling is widely used in qualitative research for the identification and selection of information-rich cases related to the phenomenon of interest” (Abstract, para. 1). The use of purposeful sampling techniques supports qualitative data development to better explore research questions with depth. Each sample participant for district administrator and
teacher interviews and focus group discussions were selected through purposeful sampling techniques including criterion-based and snowballing techniques.

**Interviews**

Interview participants were selected from each school district following a specified criterion sampling protocol. Prior to sample recruitment, criteria were drafted to safeguard similar viewpoints between the two school districts observed in the study. Table 17 indicates the criteria used for administrator and teacher interview recruitment.

**Table 17**

*Criteria for Participation in Administrator and Teacher Interviews*

<table>
<thead>
<tr>
<th>Role</th>
<th>Criteria</th>
</tr>
</thead>
</table>
| Administrator  | 1. Current district level or building level administrators (e.g., superintendent, assistant superintendent, principal, assistant principal, associate principal, or program director) of each district site. Hierarchy of service title level was significant in requirement with higher title being recruited at each building level.  
2. District A administrator recruitment included length of service to ensure participation of 1:1 laptop learning environment.  
3. Years of overall educational service were used in the event of possible participants’ equality in other criteria areas. Educators with more years of service were recruited first. |
### Table 17 (continued).

<table>
<thead>
<tr>
<th>Role</th>
<th>Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teacher</td>
<td>1. Current building level teachers in the core subject areas of English, science, and math from high schools within each district site. These subject areas were specified to correlate with the hypotheses examined in the quantitative component.</td>
</tr>
<tr>
<td></td>
<td>2. Teachers who taught majority of upper level secondary students (i.e. juniors and seniors).</td>
</tr>
<tr>
<td></td>
<td>3. District A teacher recruitment included length of service to ensure participation of 1:1 laptop learning environment.</td>
</tr>
<tr>
<td></td>
<td>4. Teacher has at least 10 years of experience in education. Seasoned teachers with more experience were recruited in the event of possible participant equality in other criteria areas.</td>
</tr>
</tbody>
</table>

The interviews were designed to include administrators \((n = 3)\) and teachers \((n = 3)\) from each school district. All interviews were conducted at the convenience of the participant and within their own school or office setting. For the purpose of the study’s reported findings, all names used are pseudonyms to protect participant confidentiality.

The sample of administrators for District A included the following: T. Hawkins, a high school principal with 17 total years of experience with 12 years in administration; A. Tucker, an associate principal with 18.75 total years of experience with 11 years in administration; and N. Cunningham, an assistant principal with 30 years of total experience with 20 years in administration. The sample of teachers from District A included the following: L. Freeman, an English teacher with 11 years of teaching experience; S. Williams, a science teacher with 18
years of experience; and M. Smith, a math teacher with 21 years of teaching experience. All District A teachers have taught at the 1:1 high school prior and during the 1:1 laptop implementation. Current teaching assignments for these participants included senior English, AP English IV, dual enrollment English and math courses, algebra II, AP biology, and ACT® prep.

Administrator and teacher recruitment was among all three high school sites within District B. One high school site declined to participate in the interview process. The sample of administrators for District B included the following: B. Matthews, a district administrator with 18.5 total years of experience and 14.5 years in administration; D. Reynolds, a high school principal with 28 years of experience including nine years in administration; and T. Long, a high school principal with 15 years in education with 10 years in administration. The sample of teachers from District B included the following: V. Brown an English teacher with 15 years of experience; B. Dixon, a science teacher with 30 years of experience; and N. Jacobs, a math teacher with 19 years of experience. Current teaching responsibilities included accelerated English III, AP English IV, dual enrollment English courses, geometry, chemistry, and physical science.

Interview sessions lasted approximately 20 to 40 minutes. Each interview session was audio-recorded and transcribed for data reporting and analysis purposes. A total of one district administrator, three principals, one associate principal, one assistant principal, and six teachers were interviewed in the study. Table 18 indicates the interviewee-participants’ names and associated characteristics. Table 18 states the following:
Table 18

Interviewee-Participants’ Information

<table>
<thead>
<tr>
<th>Name</th>
<th>District/School</th>
<th>Role</th>
<th>Total years of experience</th>
<th>Total years of administration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tom Hawkins</td>
<td>A</td>
<td>Principal</td>
<td>17.00</td>
<td>12.00</td>
</tr>
<tr>
<td>Avery Tucker</td>
<td>A</td>
<td>Associate Principal</td>
<td>18.75</td>
<td>11.00</td>
</tr>
<tr>
<td>Nic Cunningham</td>
<td>A</td>
<td>Assistant Principal</td>
<td>30.00</td>
<td>20.00</td>
</tr>
<tr>
<td>Lily Freeman</td>
<td>A</td>
<td>English Teacher</td>
<td>11.00</td>
<td>N/A</td>
</tr>
<tr>
<td>Matt Smith</td>
<td>A</td>
<td>Math Teacher</td>
<td>21.00</td>
<td>N/A</td>
</tr>
<tr>
<td>Sarah Williams</td>
<td>A</td>
<td>Science Teacher</td>
<td>18.00</td>
<td>14.50</td>
</tr>
<tr>
<td>Bob Matthews</td>
<td>B</td>
<td>District Administrator</td>
<td>18.50</td>
<td>14.50</td>
</tr>
<tr>
<td>Tim Long</td>
<td>B1</td>
<td>Principal</td>
<td>15.00</td>
<td>10.00</td>
</tr>
<tr>
<td>Dan Reynolds</td>
<td>B3</td>
<td>Principal</td>
<td>28.00</td>
<td>9.00</td>
</tr>
<tr>
<td>Violet Brown</td>
<td>B3</td>
<td>English Teacher</td>
<td>15.00</td>
<td>N/A</td>
</tr>
<tr>
<td>Blake Dixon</td>
<td>B3</td>
<td>Science Teacher</td>
<td>30.00</td>
<td>N/A</td>
</tr>
<tr>
<td>Naomi Jacobs</td>
<td>B1</td>
<td>Math Teacher</td>
<td>19.00</td>
<td>N/A</td>
</tr>
</tbody>
</table>

Note. A = District A; B1 = District B, School 1; B2 = District B, School 2; and B3 = District B, School 3; *Pseudonyms used.

Focus Group

Focus group participants were comprised of 2014 high school graduates representing each school district in the study. A snowball sampling technique was used to generate participant recruitment. School officials at each district site provided possible participants
under the criteria that the person was a 2014 graduate and currently enrolled at one of three local community college and university school sites (CC1, University1, University2). Before recruitment contact, recommended participants were checked and confirmed to be graduates from the school district having attended all four years within the district. District A recommendations also included verification of participation in the 1:1 laptop program for all four years of high school. Recommended participants from school sites were contacted for possible participation. Recruited participants were offered opportunities to suggest other possible participants who might be willing to participate and bring valuable insight to the discussions. Again, these recommendations were reviewed and confirmed for specified criteria to be included in the focus group meetings. Snowballing recruitment continued until participant convergence occurred or adequacy of participant confirmation was met.

A total of six discussions were held where data were collected and aggregated for analysis and reporting. Two meetings were administered at each of three local community college or university sites representing both school districts. Total participants represented for District A were 12 and for District B were 10. Participants of District B represented all three high schools in the district. School B1 had three participants, School B2 had four participants, and School B3 had three representatives. Participants from both districts (a) ranged in age from 18 to 19 years, (b) consisted of both male and female students, and (c) represented African American, Hispanic, Middle-Eastern, and Caucasian racial and ethnicity makeups. A total of 11 males and 11 females participated in the study. A total of eleven 18-year-olds and eleven 19-year-olds participated in the study. A total of 18 Caucasians, two African Americans, one Hispanic, and one Middle-Eastern participated in the study. Table 19 represents focus group participants and demographic information. Table 19 states the following:
Table 19

*Focus Group Participants’ Demographics*

<table>
<thead>
<tr>
<th>Name</th>
<th>District/School</th>
<th>College enrollment</th>
<th>Sex</th>
<th>Race/Ethnicity</th>
<th>Age</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anthony Jones</td>
<td>A</td>
<td>CC1</td>
<td>M</td>
<td>Caucasian</td>
<td>19</td>
</tr>
<tr>
<td>Audrey Smith</td>
<td>A</td>
<td>U1</td>
<td>F</td>
<td>Caucasian</td>
<td>18</td>
</tr>
<tr>
<td>Brayden Lewis</td>
<td>A</td>
<td>CC1</td>
<td>M</td>
<td>Caucasian</td>
<td>18</td>
</tr>
<tr>
<td>Caden Carr</td>
<td>A</td>
<td>CC1</td>
<td>M</td>
<td>Caucasian</td>
<td>18</td>
</tr>
<tr>
<td>Chris Taylor</td>
<td>A</td>
<td>U2</td>
<td>M</td>
<td>Caucasian</td>
<td>19</td>
</tr>
<tr>
<td>Emma Albright</td>
<td>A</td>
<td>U2</td>
<td>F</td>
<td>Caucasian</td>
<td>19</td>
</tr>
<tr>
<td>Grace Kimble</td>
<td>A</td>
<td>U1</td>
<td>F</td>
<td>Caucasian</td>
<td>18</td>
</tr>
<tr>
<td>Jack Ricks</td>
<td>A</td>
<td>U2</td>
<td>M</td>
<td>Caucasian</td>
<td>19</td>
</tr>
<tr>
<td>Jeff Martin</td>
<td>A</td>
<td>U1</td>
<td>M</td>
<td>Caucasian</td>
<td>19</td>
</tr>
<tr>
<td>Madelyn Walker</td>
<td>A</td>
<td>U1</td>
<td>F</td>
<td>Caucasian</td>
<td>18</td>
</tr>
<tr>
<td>Melanie Clark</td>
<td>A</td>
<td>U1</td>
<td>F</td>
<td>Caucasian</td>
<td>18</td>
</tr>
<tr>
<td>Wade Green</td>
<td>A</td>
<td>CC1</td>
<td>M</td>
<td>Caucasian</td>
<td>19</td>
</tr>
<tr>
<td>Connor Turner</td>
<td>B1</td>
<td>U2</td>
<td>M</td>
<td>Caucasian</td>
<td>18</td>
</tr>
<tr>
<td>Sophia Morris</td>
<td>B1</td>
<td>CC1</td>
<td>F</td>
<td>Caucasian</td>
<td>19</td>
</tr>
<tr>
<td>Tessa Bailey</td>
<td>B1</td>
<td>CC1</td>
<td>F</td>
<td>Caucasian</td>
<td>18</td>
</tr>
<tr>
<td>Ava Hughes</td>
<td>B2</td>
<td>U1</td>
<td>F</td>
<td>White/Middle-Eastern</td>
<td>18</td>
</tr>
<tr>
<td>Charles Ross</td>
<td>B2</td>
<td>CC1</td>
<td>M</td>
<td>Caucasian</td>
<td>18</td>
</tr>
<tr>
<td>Jeremy Miller</td>
<td>B2</td>
<td>U2</td>
<td>M</td>
<td>Caucasian</td>
<td>19</td>
</tr>
<tr>
<td>Maria Young</td>
<td>B2</td>
<td>U1</td>
<td>F</td>
<td>Hispanic</td>
<td>19</td>
</tr>
<tr>
<td>Allison Adams</td>
<td>B3</td>
<td>U1</td>
<td>F</td>
<td>African American</td>
<td>19</td>
</tr>
<tr>
<td>Ashley Hill</td>
<td>B3</td>
<td>U2</td>
<td>F</td>
<td>African American</td>
<td>19</td>
</tr>
<tr>
<td>Wyatt Bell</td>
<td>B3</td>
<td>CC1</td>
<td>M</td>
<td>Caucasian</td>
<td>18</td>
</tr>
</tbody>
</table>

*Note.*  
A = District A; B1 = District B, School 1; B2 = District B, School 2; B3 = District B, School 3; CC1 = Community College; U1 = University 1; U2 = University 2; M = Male; F = Female.  
*Pseudonyms used.*
Focus Group Pilot Study

A pilot study was conducted to explore the focus group discussion process and validate the focus group interview questions. Participants of the pilot study were high school graduates from four different high schools in North Mississippi including District A and District B of the research study. None of the participants qualified for participation in the research focus group study but provided a healthy sample resembling focus group participant characteristics. Six people participated in the pilot study. Ages ranged from 18 to 20 years with male and female participants and Caucasian and African American racial makeups. Participants were currently enrolled in college while currently or previously attending both two-year and four-year institutions. Pilot study participants were recruited through mutual contacts of the researcher.

The pilot study followed the same prepared focus group study protocol including the discussion setting, consent procedures, and audio- and video-recording techniques. Upon arrival, participants were introduced to others and reviewed the consent form. Participants were offered opportunities to ask questions and gain any clarification needed prior to the pilot study meeting. The actual pilot study discussion lasted approximately 20 minutes. The study provided two valuable insights in preparing for the focus group discussions. First, each focus group makeup needed to be representative of only one school district. Mixing participants from both districts might discourage participant engagement. Secondly, the questioning protocol needed changes to ensure question validity. Procedures in conducting the meeting were identified and confirmed as well as validation of the questions used in the pilot study.

The pilot study had a heterogeneous group in relation to the overall topic of the research study. Two of the participants attended District A and were exposed to a 1:1 laptop environment during high school. Two of the participants attended District B, and the other two
participants attended high schools outside of the research study sample. These four students all attended high schools with shared or limited technology access. During the discussion participants representing the two distinctively different high school technology capabilities made nonverbal and verbal cues when discussing technology access and integration experiences. The cues had a negative connotation leading to a suspected tendency for some participants to disengage from the discussion. For example, a participant who graduated from District A indicated a lack of preparedness for college although she attended a 1:1 high school. Her main concern stemmed from no use of email in high school, but it was extremely important in college. The participant indicated that, although she did have access to a laptop, not using email as a main communicative device resulted in her being ill-prepared for experiences at a local university and behind academically.

Alternatively, one student who attended a District B high school with limited and shared technology resources indicated levels of responsibility had a vital impact more so than just having access to the technology. The student’s response appeared to address responsibility as the issue—not lack of email communication. The next comment from the District A participant came four minutes later and only after being asked directly from the moderator as a means to engage back in the discussion. When engaged back into the conversation, the moderator posed the question of how the high school could improve preparation. Her response was having classes teach more responsibility or having email would have been helpful. The student seemed to be contemplating the response from the District B student concerning responsibility so much it was an immediate answer when purposefully engaged back in the discussion. These dynamics indicated a need to separate the two groups to help ensure depth in the conversation.
from all participants. Otherwise, the nonequality in technology access could cause a division among the participants and possibly limit the depth of discussion.

From the beginning of the pilot study, there was an obvious separation between the two groups, thereby making it difficult to explore each perspective in-depth. Each perspective was so vastly different in regard to technology access and integration. Students in a 1:1 environment had 24/7 technology access and integrated learning experience throughout high school. Students from a shared environment had very little technology access and integrated learning experiences. This demonstration between the two groups in the pilot confirmed focus group meetings needed to be more homogenous in their makeup, particularly in regard to technology access and integration opportunities in high school.

A main focus of the pilot study was to validate the interview questions. Analysis of participant responses indicated needed adjustments in the questioning protocol. Issues of terminology indicated the need to better define specific words through uses of examples. Also, ambiguity of one question was recognized due to participant perspectives. Based upon emerging perspectives, the original questions and pilot study implications are described in the next section.

**Question one.** Question one asked the following: What are your attitudes toward technology access and integration in high school in reference to your first-year college and/or career experiences beyond high school? Pilot study answers lacked depth in regard to participant attitudes and perspectives. Most of the answers revolved around the technology offered in college for communicative needs (e.g., email, learning management systems, and online textbooks). Participants without high school technology experiences easily made connections between high school and college because those technology aspects were not
accessible in high school. However, participants from the 1:1 laptop experience provided very little or no input and with only one indicating a lack of preparedness in using email as a detriment to her first semester college experience. Pilot study participant answers to question one indicated a need to better define technology access and integration and better support discussion for participants to make connections between high school and college.

**Question two.** Question two asked the following: In what ways were your high school learning experiences enhanced by technology? Provide specific examples of technology integrated learning experiences. Pilot study participants gave examples of technology type classes (e.g., digital photography and yearbook) with one mention of typing skills specifically toward research type experiences. The participants appeared to have difficulty understanding the term integration and making connections about specific levels of integration. This question was similar to question three where the only differentiations were the levels of integration.

**Question three.** Question three asked the following: In what ways did technology transform your high school learning experiences? Provide specific examples of these technology integrated learning experiences. Pilot study participants described teachers using visual supplemental support for lectures with PowerPoints. One participant described an experience where students created PowerPoints to teach the class a history lesson. Again, a lack in the variety of responses indicated possible confusion of the term integration, especially distinguishing between the different levels described in questions two and three. Therefore, these two questions were combined to ask the following: In what ways were your high school learning experiences enhanced or transformed by technology? Provide specific examples of technology integrated learning experiences. The goal in combining these questions was to help
participants simply focus on technology integration experiences regardless of the level of integration.

**Question four.** Question four: Can you describe learning experiences using technology as a tool or resource to support specific content standards or learning outcomes? Participants had difficulty understanding this question. The question stems more toward an educator perspective. Participants had to ask for it to be restated. Only one participant was able to verbalize an adequate answer. Therefore, this question was taken out of the focus group protocol.

**Question five.** Question five asked the following: What are your perspectives of technology access and integration implications on success in college and/or career pathways? Describe skills or strategies learned in high school that have carried over to support your first year beyond high school.

This question generated a lot of discussion from most all participants. Participants discussed needing technology sense to be successful in how the overall college or university system worked. Participants also described technology-integrated experiences that were necessary for successes in college learning experiences (e.g., research). One participant stated, “We use the same databases at community college that we used at my high school.”

**Question six.** Question six asked the following: How can technology be better used to support high school experiences to better prepare students for college and career? Participants provided adequate responses to this question. Participants described elements specifying digital citizenship components as well as career skills, such as résumé development.
**Question seven.** Question seven: Describe your beliefs concerning technology’s impact on your performance on standardized tests. Participants provided a range of answers describing how technology impacted standardized test for paper/pencil administration. One participant described her experience as, “I remember when I had trouble with like calculus I could go to a website online that taught me like step by step how to do stuff. So, like when I saw it on the ACT it helped.” Another participant also confirmed that, “I remember using the Internet for practice problems for the ACT.” Discussions of online assessments emerged and participants debated about possible performance implications providing more validity to the question in support of the research study.

The pilot study provided opportunities to explore considerations for improvement in the administration of the impending focus group discussions as well as validate questions and instigate appropriate changes to the interview protocol. Separation of the districts’ representatives was confirmed to ensure a homogenous group in regard to the different levels of technology access and integration. In the questions protocol, documentation of clarifying term definitions with use of appropriate examples was made. Questions two and three were combined to help better extract response of technology integration from participants. Question four was eliminated due to inappropriate stem in reference to participants’ perspective. Updated and finalized questions are reflected in Appendix C.

**Research Study**

The qualitative process of this mixed-method study used a triangulated approach to extract data relevant to the study research questions. The data findings resulted from an analysis of the following: (a) public access to school board minute documents for each school
district during four school years between 2010 and 2014, (b) interview sessions from district
and school administrators and teachers, and (c) focus group meetings representing 2014
graduates of each school district.

Data was collected from each source where all materials including documents, video
and audio files, and transcriptions were entered into NVivo software package for analysis.
According to Creswell (2014), the data analysis process “…involves segmenting and taking
apart the data…as well as putting it back together” (p. 195). The initial analysis began by
reviewing the data and identifying elements of interest to the research questions. Using the
NVivo software, words, phrases, and passages were coded into categories based on topics
(Morse & Richards, 2002). The qualitative phase explored each districts’ perceptions and
attitudes toward technology aspects. Therefore, initial coding examples include codes such as
curriculum, beyond high school, software, and assessment. Continuous review of data and
coding schemes helped identify connections where broader categories were designed to
organize data to better address the research questions of the study. For example, categories such
as transformational technology uses, technology enhancement uses, and college and career
were developed. As coding for data categories continued to evolve, transformation into themes
as major findings ensued (Creswell, 2009; Creswell, 2014).

This section reports the analysis findings separated by four common-threaded themes
for each school district: (a) levels of technology access, (b) levels of technology integration,
(c) technology implications on success in college and career, and (d) technology implications
on standardized tests. Perceptions and attitudes of each district are described for each theme.
Pseudonyms are used in the research findings to protect confidentiality of all study participants.
Perceptions and Attitudes of District A

The perceptions and attitudes of District A were drawn from analysis of board minutes between the years of 2010 and 2014, interviews with six educators including building administrators and teachers, and focus group meetings of 2014 graduates.

Levels of technology access. Technology access at District A is identified at high levels as demonstrated by references of school board approvals and descriptions developed in interview sessions with educators and graduates. There was an abundance of technology resources documented as well as discussed by District A participants.

Document review. Board minute documentation from September 13, 2011, identified a MacBook 1:1 update by the district deputy superintendent. On October 11, 2011, a MacBook distribution report was given on all three 1:1 school sites including the high school. The district technology director updated the school board on district bandwidth upgrade options to go from 100 MEGS to 250 MEGS in support of Internet services. References to 1:1 laptop handbook and electronic devices are made periodically through all four years reviewed. Discussion of digital transition plans as well as yearly technology plan were also documented.

Interviews and focus groups. According to educators of District A, student access to technology is prevalent and offers unique opportunities for teaching and learning. T. Hawkins, the high school principal, said:

. . . we are fortunate to have technology that is provided by the school district. I've often said that is a great equalizer for students, because it puts every student on a level playing field. If one person has one piece of equipment and then another student sitting right beside him has a different piece of equipment they aren't on the same level playing field. They could possibly get different results for the desired outcome. (personal communication, February 6, 2015)
A 1:1 laptop-learning environment provided by the high school for each student eliminates impacts of socioeconomic levels on student learning experiences. The assistant principal, N. Cunningham also confirmed this belief:

. . . their ability to be able to have computers that we have provided for them is an excellent opportunity. Number one, it gives students who are not financially able the opportunity to receive the same technology that students who are financially able. So, it places the students on an even playing field. (personal communication, February 9, 2015)

Educators in the district recognized the privilege of technology access and noted the implications for their students. A. Tucker (personal communication, February 9, 2015) stated that, “Fortunately for us, we are blessed to have so many accesses, so many opportunities, so many devices, so many everything when it comes to technology. Our students are very fortunate to have that.” Students also recognized the technology access privilege afforded to them in high school. A. Smith (personal communication, February 24, 2015) said, “I think there's definitely a privilege for us to get to have MacBooks. I know a lot of high schools don't have that.” Jones (personal communication, March 2, 2015) confirmed that, “In high school, we have a lot of access to technology. And it's really beneficial.”

Although District A provides a 1:1 laptop-learning environment, unique challenges arise with this access. Some of the challenges include outdated technology and new layers of technology access. According to S. Williams a science teacher,

. . . the technology that was the end-all, be-all is now six years old. In my personal experience, I feel like our technology at this point is older and it's beginning to fail us…its slow, it’s frustrating. It used to be the best thing going. (personal communication, February 12, 2015)
District A is in the fifth year of the 1:1 laptop program. Having a 1:1 program is a great asset, but when the technology wears and does not work at the level needed teachers and students have new challenges. Principal T. Hawkins also pointed out concerns when trying to improve upon these current levels of technology access:

Part of the issue is the financial implications of it. You spend x amount of dollars in resources and then you have that and then in two years it is outdated. That is probably one of the biggest things that we struggle with. We save up, we get it and then two years later it is outdated. (personal communication, February 6, 2015)

Supporting and sustaining adequate technology is an ongoing concern for all stakeholders. Issues of purchasing technology and maintaining acceptable uses as technology advances are constant challenges.

N. Cunningham (personal communication, February 9, 2015) described barriers such as Internet filters hindering teacher and student access. He stated:

We’ve got to be able to allow the teachers to be able to have the tools they need. We have to be able to have the students have access to some of the great learning tools that are out there, the You Tubes and things that are out there. Our teachers are trying to get access to . . . they are trying to get through the filter system to teach some of the great things that are out there.

Students also claimed frustration with this Internet access. E. Albright (personal communication, March 4, 2015) reported, “If we had a paper or something to write, then it was really hard trying to get on websites and stuff because a lot of them were blocked. That was very frustrating in high school.”

Although access to the computer and Internet were available, often times the security filter stymied teaching and learning. There are also concerns surrounding student responsibility with technology access in the classroom. L. Freeman said that,
in order for them [students] to be successful there are some implications. They have to have a respect for technology and digital citizenship in order to be successful, attentive in class, but also using the technology that's before them. Because they are allowed to have iPads and Macbooks, computers, and phones in class it's up to them to have that discipline to use it to their benefit. (L. Freeman, personal communication, February 19, 2015)

Different levels of technology access specify a new perspective on student responsibility and how it is used in classrooms. This implies responsibilities of teacher classroom management as well as student self-discipline and respect for learning. According to C. Taylor,

In high school, technology was very much so abused, especially because people didn't really have the choice of whether they wanted a MacBook or not. You just issued one, and then you get to do what you want with it. The administration would try and set up boundaries and stuff like that so you couldn't download movies, or get games, but there was always ways around it. (C. Taylor, personal communication, March 4, 2015)

Student access to technology provided opportunities for educational usage, but at the same time opportunities for inappropriate practices developed. Although school administration established laptop guidelines to support educational purposes, students took advantage of the access for personal usages that were not appropriate for school issued devices. J. Martin corroborated a similar perspective:

I kind of relate it to the quote, ‘with great power comes great responsibility.’ You have the power to find any answer you could possibly find or just teach yourself basically with technology. But at the same time it doesn't do you any good if you don't have the self-responsibility. (personal communication, February 24, 2015)

Some students struggled with the wealth of responsibility that came with 24/7 access to a laptop. Although the laptop provided an exceptional opportunity for learning, some students did not have the maturity and self-discipline to use it appropriately. M. Walker (personal
communication, February 24, 2015) said, “They [Macbooks] were used for a lot the right reasons, but a lot of the wrong reasons, too.”

Students described the technology as oftentimes a distraction where inappropriate uses, such as playing games, downloading videos or music, or just web surfing, happened during academic classes or during independent study times where intentions were for academic focus.

District A’s unique perspective of levels of technology access indicated opportunities of equality and establishing opportunities for meeting the needs of today’s students. However, with more access come more challenges. For District A, these obstacles came with sustaining a high level of technology access, new variations of technology access, and new layers of student responsibility.

**Levels of technology integration.** District A high school learning experiences with integrated technology vary between enhancement and transformational levels of Puentedura’s (2008) SAMR model. With 1:1 technology access come maximized opportunities to integrate technology into other curriculum areas. Perspectives from District A described both enhanced and transformation technology integrated learning experiences.

**Documentation review.** Board minutes for District A identified reference to curriculum support through the use of technology. The district technology specialist provided an update on using the district learning management system as a communication tool for curriculum and instructional support. Descriptions were also made to software packages purchased to support mostly enhancement levels of technology integration (e.g., iCore and Ebook Project). However, some transformational levels were indicated such as A+ Computer Based Curriculum Delivery and Classworks. Both software applications provide online curriculum for personalized learning experiences. References on instructional shifts from physical textbooks
to online textbooks were described. More currently, references to an ebook project implemented through all grade levels were explained. Mention of a newly developed course was also portrayed, such as Digital Media Technology, which is offered within the career center course selection.

**Interviews and focus groups.** M. Smith (personal communication, February 13, 2015), math teacher, described technology integration only effective if used appropriately. He suggested in math often technology is used as a “substitute for student understanding. If they can get an answer out of the calculator then we consider that to be acceptable and sometimes that leads to students just learning to push buttons.” M. Smith (personal communication, February 13, 2015) recommended ensuring appropriate use to develop a “big picture” and hopefully, deeper understanding:

And there's so many things that we can do with the calculator to help students get big picture ideas instead of getting caught up in the minutia of how to create a certain graph or how to go through this long derivation. Ah, as a matter of fact, yesterday we did a technology activity on quadratic equations and the focus of the activity was getting the students to see how changing one of the numbers in the formula shifts the graph around. That would of taken days to do that many graphs by hand, the students did 20 graphs and answered all the questions, found the vertices, and found the zeros in a matter of 30 minutes to an hour.

M. Smith (personal communication, February 13, 2015) believed appropriate technology integration allows one “to create multiple representations, different ways of looking at things.” For example, he stated:

Helping student's understand the translation of a parent function. The parent function being the base quadratic Y equal 8 squared. By the technology activity, we had them look at several problems that were in the form, Y equal X squared plus K. By looking at all those examples and comparing those examples, they are able to recognize, and most of them did, that K on the outside just moved it up and down. So they get to see for themselves something instead of me telling or me modeling them. They get to work
with the numbers and work with the graphs and see it for themselves. And it's like they're developing the rule, they're discovering the rule. (M. Smith, personal communication, February 13, 2015)

Technology allows for hands-on learning in math. The ability to reinvent the learning experiences from traditional aspects allows for a more student-centric feature. L. Freeman (personal communication, February 19, 2015) also supported this idea by stating the following: “It [technology] gives them multiple experiences with the content through different mediums.”

She described an activity where learning was enhanced by accessing a YouTube video from the Internet and projection on a smartboard to better understand *Paradise Lost*. L. Freeman (personal communication, February 19, 2015) explained:

In book six it talks about the battle between Satan and God and one of the students pointed out the similarities between what Milton has written, and the *Chronicles of Narnia*. And so we could easily pull up a book clip of four minutes. . . Maybe not even four minutes on YouTube. . . to give that visual for the students who couldn't imagine it the way Milton portrayed it. It was very identical. So for those students, and once they saw it, it was like ‘oh.’

In this instance the technology allowed students to make connections between two literacy genres written centuries apart through Internet access to a YouTube video. S. Williams (personal communication, February 12, 2015) was confident computer animations had added a level of learning not previously found in her biology students. She explained the following:

I know for a fact that my kids have a much better understanding of all the intricate details in Molecular Biology especially because of all these computer animations that have come about. I can talk to a kid all day long about how protein is synthesized at the ribosomes, taking one amino acid to another and it just falls on deaf ears. . . until you play a video where its computer animated and it shows it in real time. This is happening right now in your cells as we speak. This is what's going on. They can learn it--the words, but when you put the words to a video that shows it occurring, it makes all, a huge difference.
The science animations allowed students real-time experiences for understanding sophisticated and complex biological processes. S. Williams (personal communication, February 12, 2015) also described data collection devices used in chemistry that provide students with live data to manipulate for analyses. These types of technology uses promote student learning by enhancing the student experience through different mediums.

Most all of the students reported word processing, PowerPoint or Keynote presentations, research, access to online databases, and use of a learning management system as part of the enhanced learning experiences in high school. Some students described enhanced integrated technology high school experiences to be engaging and fun. For example, M. Walker (personal communication, February 24, 2015) and G. Kimble (personal communication, February 24 2015) described creating and performing a rap to the quadratic formula to demonstrate understanding in algebra II. A. Smith (personal communication, February 24, 2015) and J. Martin (personal communication, February 24, 2015) explained how much they enjoyed creating a movie parody on a book report in English class. A. Smith (personal communication, February 24, 2015) also depicted how she created a social media experience for Romeo and Juliet in ninth grade English. M. Walker (personal communication, February 24, 2015) stated, “I just like combining creativity with . . . “

A. Smith (personal communication, February 24, 2015) completed by stating “. . . technology.” These supplemental technology activities engaged students and created fun learning experiences.

The equality of technology access ensures teachers and students opportunities to integrate transformation learning beyond the classroom walls and outside of the traditional time limits placed at school. For example, administrators and teachers described many experiences
prevalent in District A by harnessing the potential of technology for learning through communication and collaboration tools. Assistant Principal N. Cunningham (personal communication, February 9, 2015) stated, “The collaboration piece we’ve been looking for--more than just sitting four around a desk. They can be miles apart and still collaborating. That is getting into the 21st century learning skill that we are trying to produce.” For example, “Now [since the 1:1] the students are able to do that [collaborate] from home or they can be on vacation they can be at spring break and still working on their senior project (N. Cunningham, personal communication, February 9, 2015).

Administrators described uses of GoToMeeting or Facetime as opportunities encouraged for student collaboration. C. Carr (personal communication, March 4, 2015) and E. Albright (personal communication, March 4, 2015) described their collaboration experiences using Google Drive and Facetime while working on their senior project. E. Albright (personal communication, March 4, 2015) said, “Google drive saved us in our senior project.” Carr (personal communication, March 4, 2015) described, “You could allow anybody to edit. So you could watch somebody type all on Google drive and you could see what they're doing. You could edit what they've done, and they could edit what you've done.”

E. Albright (personal communication, March 4, 2015) continued the conversation of using technology to collaborate:

A lot of people couldn't make it to meetings. For instance, they didn't have cars or they couldn't come to our meeting at somebody's house or meet up for projects. So, we used the Google drive, and also used Facetime. We brought her [another student] on Facetime to the meeting. It was kind of cool.

Technology provides students the ability to connect and collaborate beyond the traditional classroom experiences supporting transformational learning. L. Freeman (personal
communication, February 19, 2015) provided an example of how students use technology to connect with mentors for the senior project. She stated:

A lot of times the students use it for networking. Whether it is group messaging or Facetime, there are times when they have to Facetime with their mentors. Sometimes the mentors travel a lot and so they're willing to FaceTime with them. (L. Freeman, personal communication, February 19, 2015)

Technology also allows students to connect and collaborate beyond the classroom walls with experts in the real world setting to support learning experiences. T. Hawkins (personal communication, February 6, 2015) described this as an area to improve upon by possibly connecting with other schools, classes, and students to support specific learning standards or outcomes. Regardless of mentioned improvements, District A is utilizing communication and collaboration tools to transform learning experiences outside the traditional school environment.

Another transformational aspect involves opportunities with teacher and student by instant feedback, thereby giving formative data more efficiently. In reference to ACT® Prep course, S. Williams (personal communication, February 12, 2015) stated:

I do feel like the individualized instruction that they get from ACT prep is something that would not occur without technology. Obviously I have seventeen kids in here, I'll have no idea where each of them is as far as preparing for the ACT, but they take a practice test with this piece of technology and immediately a program is built around their strengths and weaknesses.

The opportunity to individualize learning with technology supports differentiated teaching in transformational experiences. T. Hawkins (personal communication, February 6, 2015), the principal, described it more in general association,
We have instant feedback. Students are using that technology to respond to questions. As a teacher you're getting instant feedback from every student. Your getting instant feedback on whether that student is getting it or not.

M. Smith (personal communication, February 13, 2015) described his dual enrollment class using MathLab as extremely beneficial because students have the ability to get instant feedback and seek support when needed. “It’s allowed us to push at a different pace but it's also allowed students instant feedback and that instant feedback is what intrigues me the most.”

M. Smith (personal communication, February 13, 2015) recognized this with such great impact that he would like to integrate and develop for his algebra II students as a means to ensure more personalized learning. “Many of these software programs and much of the technology now, can actually tailor the work to the student needs.” Individualized learning and instant feedback are two transformational teaching and learning experiences supported by technology in District A.

Some students described high school experiences as support by technology because technology was so heavily a tool or resource needed for the course. W. Green (personal communication, March 2, 2015) explained, “A lot of my classes were technology oriented, such as, I took a class all about video editing, broadcast journalism, and the computer graphic design class. And all of those relied heavily on the technology we were given.”

W. Green (personal communication, March 2, 2015) stated that without the wealth of technology in his high school these courses would not have been available. Other courses described included yearbook and media arts. A. Smith (personal communication, February 24, 2015) reminded us that her high school had “opportunities that not every school can have” because the technology in place afforded growth in courses supported by technology.
Implications on success in college and career. District A’s perspectives on technology’s implication for success in college and career is positive. District A administrators, teachers, and student suggested technology has a significant impact on preparing for a future beyond high school. According to A. Tucker (personal communication, February 9, 2015),

I think technology needs to be incorporated in every component of every program, every course. There would be no reason not to have technology in every class, whether it’s theatre, English, or math. There should be no reason to have some type of technology because if we don’t we are leaving our kids behind. They are going to need those skills in order to be competitive at the college level or the career level.

The principal, T. Hawkins (personal communication, February 6, 2015) confirmed, “You look at Toyota…everything over there is robotic. You have to have a foundation. You don’t have to be proliferate in it but you have to have a proficient knowledge to function in the college and career ready environment.”

T. Hawkins (personal communication, February 6, 2015) believed his high school offering a 1:1 laptop access has provided this foundation. He suggested the culture of using technology in teaching and learning has been created and, therefore, “the learning curve has been taken away.” B. Lewis (personal communication, March 2, 2015) described, “If you don't know how to use the computer it could be much more of a hindrance than a help. So, I think it's important that you learn the skills very early on.” The assistant principal, N. Cunningham (personal communication, February 9, 2015) concurred, “They [students] are able to utilize those tools that they are going to need whether it be at the university or in their own business.”
C. Taylor (personal communication, March 4, 2015) supported the school administration:

Today's job market is extremely competitive. People are always looking for something to give them the upper hand. I feel like, kind-of the experience we have coming to college . . . I feel like we almost kind of have like, a prior training. And like I said, some people did abuse that, but if you use it the right way, the way it was meant to be used, then it really was beneficial to getting us to where we are now.

Teachers in District A also suggested access to technology in learning experiences as beneficial to students beyond high school. L. Freeman (personal communication, February 19, 2015) said that, “Theoretically having experience or having access to technology in high school should prepare our students more so for the collegiate setting. It’ll be hard or difficult for students to be successful in college if they don’t integrate technology in their learning.”

Students make connections to how technology is used in high school and in college through experiences in research, learning management systems, communication, and presentations. W. Green (personal communication, March 2, 2015) suggested, “When you get to here [college], you’re thrown into that whole new world. Going to college itself is a huge change, but being able to use all the same resources, technology-wise, makes it a lot easier.” This realization aligned with J. Martin (personal communication, February 24, 2015): “I had a friend that was complaining, ‘There's so much stuff in college that you have to do online, like, I'm not use to this.’ And I said, ‘Did y'all not have computers in high school? I just wasn't thinking, because I forgot how privileged we are.’ “M. Walker (personal communication, February 24, 2015) stated that, “I definitely think, technology was a positive thing. It had it's up and down for sure, had tons of downs . . . but tons of ups too. We would be worse off without it.”
Although District A high school graduates had a rich experience with technology access and integration, there were indications that those experiences did not necessarily align to college. For example, W. Green (personal communication, March 2, 2015) suggested:

It just seems like in high school we're using technology so much more than we do at college. In high school we were able to use all the computers in the classroom; whereas, here most of the time we're stuck using paper and pencil again.

G. Kimble (personal communication, February 24, 2015) also described concerns about research requirements in college. Although she had a good foundation in online databases research, she had no experiences with traditional research processes. In one of her college classes she was required to go to the library and research. G. Kimble (personal communication, February 24, 2015) felt inadequate in this capacity, as she had learned to rely on electronic resources.

Although there are a couple of examples of misalignment, overall students requested more access and uses of technology in high school to better prepare students after graduation. B. Lewis (personal communication, March 2, 2015) suggested, “The more the better as far as technology goes.” Others provide specifics such as online homework, math online, better interaction and uses of learning management system for communication, online quizzes, online classes, ePortfolios, and developing teachers for better uses of technology in teaching and learning.

There is a consensus at District A of a foundation in technology and exposure to using technology in high school supports college and career readiness for today’s students. Even with alignment issues between high school and college, students request more access and better uses of technology in high school.
Implications on student performance on standardized tests. Perceptions of technology’s impact on student performance on standardized test is explored in District A identifying some theoretical connections. Principal T. Hawkins (personal communication, February 6, 2015) suggested, “I think it is obvious that here having a five year experience with having a 1:1 environment that it is has made a tremendous difference at scores.”

He claimed the largest impact as coming from the instant feedback that element technology allows as well as project-based learning experiences developing a deeper understanding of learning standards. N. Cunningham (personal communication, February 9, 2015) believed the 1:1 supports improved test scores. He explained:

I think 1:1 gave our kids an edge over those students that didn’t have it because they had the ability to do higher-order thinking skills. It gave the ability to do greater research, and hands on ability to see more, feel more, to know more - through the technology. Because you can get on [online] . . . you’ve got the world at your hands. Whereas, otherwise you got a textbook and that is all you got. So, 24/7 that child has the ability to practice test, to study, to research, to have all the study guides that you need, to ask questions, and to have immediate feedback from the teacher. So, I firmly believe this increased the chance of the student to pass the paper and pencil where the student that didn’t have the technology didn’t have that advantage.

Administrators of District A suggested the 1:1 laptop environment as supporting standardized test scores through efficiencies of formative assessments, higher-level learning experiences, and constant student access to available learning opportunities. ACT® prep is an online course personalized to individual student development in preparing for the ACT®. In its first year, S. Williams’ students demonstrated, “leaps of six to nine points” in scores (personal communication, February 12, 2015). She said, “ACT prep had a definite impact on the difference in what the PLAN said they would do and what they did.”
Student perceptions were mixed. Some students believed access to online resources for ACT® preparation and access to more information provided some assistance, but others suggested traditional resources as more appropriate. However, these students did suggest technology provides alternative aspects for learning and preparing for standardized test and might be helpful for others.

While exploring the trend to online standardized assessments, perceptions of technology’s impact shifted. Principal T. Hawkins (personal communication, February 6, 2015) explained:

If you know Student A has never been exposed to a computer and all of a sudden he is going in to take an online assessment where Student B knows how to manipulate, he understands the computer. Student B is definitely in an advantage over Student A. Student A is trying to figure out how to maneuver and the availability of the tool he is using. Where Student B is just going in and he's automatically ready to start demonstrating his knowledge.

Having opportunities to access and practice online assessments are an advantage for students when preparing for high-stakes or next-generation assessments given through a technological medium. However, even students from District A who experienced a 1:1 technology environment demonstrated levels of anxiety toward online standardized assessments. A. Smith (personal communication, February 24, 2015) said, “I think those test would be much harder if we had to do them online. That would stress me out.” G. Kimble (personal communication, February 24, 2015) agreed, “. . . I couldn’t imagine doing my ACT online. I would do so much worse. Students’ concerns stem over traditional testing taking skills such as highlighting, taking notes, and marking out answers. Others describe issues of maneuvering within the test and technology hiccups such as not saving, or losing connectivity. “Online over paper makes me more nervous,” said M. Clark (personal communication, March

A couple of students, however, did feel taking an online standardized test could improve student performance. B. Lewis (personal communication, March 2, 2015) said, “I think for the most part it would be a very good impact.” He claimed more comfort in reading online and having accessibility features available such as back lighting, zooming and accessing only one question at a time. W. Green (personal communication, March 2, 2015) agreed and added, “I think for timed tests it can help, too. You can shave off seconds you're not spending flipping through the book. That is you are just scrolling and clicking.” Regardless of opinion, online testing trends are prevalent and impacts on student performance are relevant.

District A perceptions and attitudes toward technology access and integration, technology impacts on college and career readiness, and technology implications on standardized test stem from a 1:1 laptop perspective. Although a 1:1 environment ensures equality for students, sustaining this level of access is an ongoing challenge. Other obstacles include managing student responsibilities and attacking new variations of technology access. The 1:1 access allows for ample opportunities of integration. District A integration levels meet the full range of Puentedura’s (2008) SAMR model in both enhancement and transformational aspects. Although most agree technology has positive impacts on college and career readiness. some concerns still remain. Most specifically, a concern is the reference to some traditional practices still in place at colleges. District A believes technology’s has impacted performance positively on standardized test. This positive impression stems from personalized learning experiences, efficient formative feedback, and deeper-learning opportunities as well as access to online practice test and test preparation. As shifts to the online medium ensue, overall
District A perceptions are positive but student attitudes are more disconcerting. Student concerns revolve around changes needed from traditional test-taking practices and technology failure aspects. District A perspectives stem from a 1:1 laptop teaching and learning environment and impact perceptions and attitudes significantly.

**Perceptions and Attitudes of District B**

The perceptions and attitudes of District B were drawn from review of board minutes between the years of 2010 and 2014, interviews with six educators including district and building administrators as well as teachers, and focus group meetings of 2014 graduates.

**Levels of technology access.** District B perceptions on technology access demonstrate frustration based on lack of adequate access and support of current access as documented in district board meeting minutes, stakeholder interviews, and focus group meetings.

**Documentation review.** Board meeting minutes document purchases of technology equipment (e.g., laptops) through federal title monies mostly identified for elementary and primary schools. Title VI, Rural Education, funding provided purchasing of 119 laptops and 14 laptop storage carts. Minutes identify purchases of Nooks for the Special Education Department, for Promethean Boards, and for mobile science labs. Many donations were accepted in the areas of technology devices (i.e. monitors, computers, and smartboards). Reports on Internet service, technology and E-Rate funding, and purchase for infrastructure are also documented in the minutes. Approval of school board policies for electronic devices was also accepted in the minutes.

**Interviews and focus groups.** B. Matthews (personal communication, February 17, 2015), district administrator, described technology access as “very limited” since all students do not have individual access to a device. He suggested most students have personal devices,
but even then the high schools do not have the infrastructure to support that type of connectivity. B. Matthews (personal communication, February 17, 2015) proclaimed only two of the three district high schools have the infrastructure to handle this year’s online testing.

The perspectives of individual buildings vary from each high school. For example, Principal T. Long (personal communication, February 5, 2015) stated, “I don't think our access is what it should be simply because we are a public school system with very limited resources.”

Students share computer labs between all classes and even then issues of time constraints, outdated equipment, and teacher skill levels ensue. N. Jacobs (personal communication, February 24, 2015), a math teacher, described her frustrations with technology access:

We don’t really have the up to date technology. The dual credit courses (college algebra, Spanish, and English) right now are having trouble finding time to just get three classes to the computers when they need them. We don’t have enough computers for all of us to use it the way we really need to. It is just not available. And, then when we do go to the computer lab, sometimes they are not all working. Or, the software is so old that it is slow and it doesn’t work with what we need it to.

Teachers and students expressed concerns over technology access and needed support. C. Turner (personal communication, March 4, 2015) described his technology access experience in high school with similar frustration:

In high school if we wanted to do something on the Internet, we had to go to the computer lab and get on these old, slow computers all at once, which made it worse. We didn't have a whole lot of access. So a lot of it was you'd just look up at your home if you had to. If you can't do that then you'd go to the computer lab in school.

As indicated, often students had to access technology outside of school because of the lack of school access with adequate features and support. This indication suggested a wider
digital divide for educational equality. C. Turner (personal communication, March 4, 2015) did describe technology access of Promethean boards in most classrooms; however, his frustration continued as he indicated little use of the smartboards from most of the teachers. Others described lack of teacher use was due to not understanding how to use the technology. W. Bell (personal communication, March 2, 2015) said, “There was a lot of attention [to the Promethean Boards] but it took the teachers forever to figure out how to get the things to work.” S. Morris (personal communication, March 2, 2015) concurred, “Half the time we’d going in there and they’d be like, “I don’t know how to work this thing!”

Students from another high school within the district described their technology access as basic. J. Miller (personal communication, March 4, 2015) said, “We actually had a computer lab, but half the time I would say 25% of the computers didn’t work, they were down, or they were slow.” According to J. Miller (personal communication, March 4, 2015), about half the teachers had Promethean boards, and one classroom set of laptops was purchased his senior year. However, he did say the wireless connectivity was very weak. “It was a hit or miss kind of thing” (J. Miller, personal communication, March 4, 2015).

C. Ross (personal communication, March 2, 2015), another student at this school, indicated, “We had pretty basic access. We had a few computer labs. We never really used them other than to do the most basic of things like make Powerpoints or write a paper for a class.”

Principal D. Reynolds (personal communication, February 10, 2015), representing another school within the district, described his building level of technology access better than most other schools in the district. The high school has wireless connectivity, mobile laptop carts, four computer labs, Promethean boards in every classroom, elmos, clickers, and tablets
available for teachers and students. Funding for this technology access came in place after the state identified the high school on priority status as a low-performing school in 2012. D. Reynolds (personal communication, February 10, 2015) described access prior to this school year, “They had 3 computer labs and they were always booked and had very little access to them.”

A teacher at the school, V. Brown (personal communication, February 19, 2015), explained technology access was prioritized for English classes. Prior to the laptop carts, English classes and other content areas had to reserve the library for access. D. Reynolds (personal communication, February 10, 2015) also identified his school with a lower socioeconomic makeup. He stated, “A lot of our students come from a lower socioeconomic. They don't have wireless at home. They don't have data plans on their phone. They don't have Internet at home. So the only technology they get is here at school.” W. Bell (personal communication, March 2, 2015) reported that he did not get wireless at home until he was 14 years old and said only then from years of begging.

Levels of technology access vary through the three high schools within District B. However, all schools are still identified as having shared or limited technology access. Access is dependent on technology devices that are current and updated as well as teacher knowledge of using.

**Levels of technology integration.** Levels of technology integration for District B hover over the enhancement stage at substitution and augmentation levels of Puentedura’s (2008) SAMR model. Some transformational experiences are provided through technology-oriented courses.
**Documentation review.** School board minutes documented purchase for curriculum support through online access and software (e.g. System 44 and Read 180 materials, V-Math, Rosetta Stone). Specifically, Study Island was purchased for one of the high schools, and 100 online courses were purchased.

**Interviews and focus groups.** Transformational integration of technology was only described through course offerings with heavily technology-supported aspects. For example, B. Mathews (personal communication, February 17, 2015) described a course where students build and fly a drone. He stated, “You look at those experiences and what it exposes kids to at an early age for possible career choice. Those things would never be possible without that type technology being in place.” B. Dixon (personal communication, March 3, 2015) proclaimed the positive effects of STEM, “because it is applied science and math that is computer-based.” N. Jacobs (personal communication, February 24, 2015), a math teacher, and V. Brown (personal communication, February 19, 2015), an English teacher both recognized the opportunities technology has brought with dual enrollment courses at their respective schools.

Many of the enhanced experiences are defined as research opportunities, creating PowerPoint presentations, and using the Internet or other software as a supplemental tool. For example, N. Jacobs (personal communication, February 24, 2015) described how it enhanced her students’ learning as follows:

> In geometry we have a program called GeoAlgbra which they can come up and it’s interactive. While we are teaching you can put it on and it has like a 3D figure, it will rotate it. That is something that has been enhanced over the last 10 years. The textbooks they have 3d drawings but you can’t rotate them.

Technology provides opportunities to go beyond the textbook, offering students new learning experiences. Being able to see and manipulate 3D objects enhances the learning
experience for visual and tactical students. W. Bell (personal communication, March 2, 2015) expressed how his teachers encouraged uses of Khan Academy as a supplemental tool outside of the classroom. He also described this enhanced learning experience:

> With Promethean Boards she [the teacher] could project these shapes on to the board. In calculus whenever you're trying to calculate the volume of a cylinder it was able to give us like an actual shape that we could work off of. Which helps all the visual kids.

N. Jacobs (personal communication, February 24, 2015) added another example in past years where she taught science:

> With the periodic table I have an interactive periodic table. We have the kids come up to the Promethean and they’d use the pen. If copper is their element they’ll highlight it and it comes up and it kind of has the basics, but they’ll add to it from what they’ve researched on their own.

The Internet and Promethean brought unique opportunities to reach a variety of learners. The technology enhanced the learning experiences by supporting specific content areas and learning outcomes.

V. Brown (personal communication, February 19, 2015) described how her students created Powerpoints, Prezis, and comic strips through access via software and the web as part of a multi-genre project. She stated, “They love the technology, and some of them are quite creative. I mean I, I haven't grasped the Prezi thing but some of them are just fabulous. Some of them can do wonders with the PowerPoint.” Providing opportunities for students to be creative in learning through technology tools allows for more student engagement in the content enhancing learning experiences.
Students described enhanced uses including clickers and slates provided more efficiency in teaching and learning. A. Hill (personal communication, March 4, 2015) described using clickers a few times in high school providing formative feedback:

Your name wasn't on the screen if you got it wrong but it showed the clicker number who got it wrong. For the teacher it would show how many, red dots or green dots when you got it right. She knew that was not something we understood so she would take time and go back through it. It wasn't like anyone was being singled out in class because they didn't understand it.

The use of clickers allowed students and teacher a more efficient opportunity for feedback on learning. J. Miller (personal communication, March 4, 2015) explained how the use of a software package helped automatically grade essays to give student immediate feedback for improvement. He stated, “Instead of having to let the teacher grade them and give them back in a week or so we could get the grade then and see what we need to work on.” S. Morris (personal communication, March 2, 2015) explained how her teacher used a slate during instruction and how it helped: “She was able to face the class rather than turn her back. So she could see, she could write, look up, write, and look up. She could see who had their hand up, who had the questions, and who looked like they didn't understand it.” The technology in these instances provided both the teacher and student formative assessment tools to guide both teaching and learning opportunities.

Most all students reported learning how to research with technology tools as an enhanced experience. Unfortunately, some of their descriptions deemed just as brief encounters. C. Ross (personal communication, March 2, 2015) said they were introduced to Magnolia and online databases to find creditable sources. He stated, “They would show us like, the basic of it, and then they'd be like, “You're gonna be using this later on.” S. Morris
(personal communication, March 2, 2015) described it as “we halfway did it.” The lack of research integration falls on the lack of access offered at each school. Principal T. Long (personal communication, February 5, 2015) stated, “We integrate it as much as we can in the educational process in terms of research. There is just a lack of access because we are so limited.” Technology integration cannot happen without technology access. Lack of access deems lack of integration opportunities and is a constant challenge in District B.

**Implications on success in college and career.** The perspectives of District B on technology’s implications on success in college and career are upbeat even though technology access and integration are a constant challenge. B. Mathews (personal communication, February 17, 2015) described the benefits of technology on developing problem-solving skills as beneficial to life beyond high school. He stated, “Technology enhances problem-solving training. And, specifically in our area with Toyota and the secondary manufactures that is what they are looking for, for people who are problem solvers.” D. Reynolds (personal communication, February 10, 2015) concurred on how technology can impact college and career. He stated, “I've visited Toyota and a bunch of their jobs. There are computers, and robotic things. Up until we got all this technology, our students wouldn't be able to compete for those jobs.” T. Long (personal communication, February 5, 2015) suggested:

> We should give them [students] as much access as we possibly can. I think both access and integration are huge parts of preparing students for college and career either way. Just to be able to function in society today is to have a good understanding of how to use technology to their benefit.

N. Jacobs (personal communication, February 24, 2015) linked technology to support deeper understandings. “A deeper understanding of the concept and you are going to carry that on and have a better understanding when you go to college.” Both administrators and teachers
of District B supported positive impacts of technology on student successes in college and career.

Students from District B also felt technology supports college and career readiness but desired more high school experiences. C. Ross (personal communication, March 2, 2015) said, “I think just more exposure would help. And just using it more often.” Most of the discussion for high school experiences dealt with communication aspects of using email and a learning management system. A. Hill (personal communication, March 4, 2015) indicated taking online quizzes would be helpful as well as access to video or audio lectures. C. Turner (personal communication, March 4, 2015) indicated a need for more technology-based courses, specifically to support him in a particular area of study:

I’m in computer engineering and I have to catch up here because they expect you to have some kind of exposure in high school and we didn’t have that at all. We had a webpage design class and that was all out of date. That was about the only computer class we had other than computer technology in 7th grade.

The majority of students wanted more technology access and integration opportunities in high school to better prepare for college.

However, there were concerns of too much technology hindering student college experiences. A. Adams (personal communication, February 24, 2015) stated, “I feel like sometimes we can be a little bit too dependent on technology. Sometimes we don't know simple things because we're so used to using technology for almost everything.” Specifically, identified was the dependency of using calculators in math. N. Jacobs (personal communication, February 24, 2015), a math teacher, demonstrated concerns for today’s students having too much use of graphing calculators in K-12 education and suggested this as a crippling component of student math knowledge and number sense. A. Hughes (personal
communication, February 24, 2015) supported this claim, “Eighth grade through twelfth grade we relied on calculators and now that I'm in college and we don't get calculators, I don't know how to do basic things.” M. Young (personal communication, February 24, 2015) described technology as sometimes too much of a dependency. A. Hughes (personal communication, February 24, 2015) also stated students never actually used the library other than to access the Internet for research. M. Young (personal communication, February 24, 2015) stated, “It would be nice to know how to go to the library and actually do research there, but I feel like I’ve never really done that.” Although most students demanded more uses of technology in high school, these two examples informed us of drawbacks in technology’s impact on college and career.

Implications on student performance on standardized tests. District B’s outlook on technology’s impact on student performance on standardized tests demonstrated mixed reviews. There was a consensus that technology could possibly help, but it was a stretch to consider it helps everyone.

Administrators recognize the bonus of having online access to practice tests and resources to support preparing for standardized tests, such as the state test or ACT®. B. Matthews (personal communication, February 17, 2015) said, “To prepare for it [the test], yeah, I think it would help because you've got a lot more access online, test prep.” D. Reynolds (personal communication, February 10, 2015) also suggested students will benefit with more avenues for learning available through technology. “They can see things that they’re not ever going to see any other way except through a computer.”

W. Bell (personal communication, March 2, 2015) claimed access to reading online has helped develop his knowledge base. He believes he would not have done as well on the ACT®
English and reading if he had not been exposed to so much online text. “I read online, a lot online” (W. Bell, personal communication, March 2, 2015). Other students mentioned having access to online practice sites as helpful in preparing for standardized tests. But, still many students felt the traditional preparation was just as adequate.

However, when shifting the discussion to online standardized tests only a couple of students felt comfortable. Most all displayed levels of anxiety or hesitancy. Students communicated concerns in regard to taking notes, summarizing, having to write out math problems, and possible technology glitches as hindrances for online testing. T. Bailey (personal communication, March 2, 2015) described lack of confidence in using the technology as a concern:

Sometimes it's harder when you have to do them on the computer, things like that, because sometimes you're concentrating more on figuring out how to put the answer in there rather than what the real answer is. You got the answer but you can't figure out how to put it in there the way they want it.

Current trends toward online assessments cause concerns for both students and teachers. More specifically, the main concern is unease with the technology because of lack adequate technology access and online practice for students. N. Jacobs (personal communication, February 24, 2015) predicted students’ movement to online standardized test as, “I think they are fine with multiple choice. The open-ended response. . . I’m not sure because they haven’t had the practice. We don’t have the resources. We don’t have enough computers to practice these types of assessments.” According to District B, shifts to online assessments will present many challenges to ensure levels of comfort with the technology.

District B perceptions and attitudes demonstrate perspectives on levels of technology access and integration, technology’s impression on college and career readiness, and
technology’s implications on standardized test. District B’s technology access was limited across the three high schools, with one high school having more access opportunities. Most technology integration activities fell within Puentedura’s (2008) SAMR model enhancement level with those opportunities limited due to shared technology access. However, there were some transformational opportunities provided through technology-oriented courses.

Administrators and teachers agreed that technology positively correlates to preparing students for college and career. Students indicated needs for more technology access and integrated experiences in high school to support college experiences. Interestingly, a couple of students also addressed concerns of negative impacts on college preparedness with calculator uses and research processes. District B agrees technology provides opportunities to practice and prepare for standardized tests and possibly improve student performance. However, some believe traditional options are just as adequate. Concerns were abundant when discussing online high-stakes testing. Issues ranged from opportunities to practice with the medium to obvious shifts needed from traditional test-taking practices. The role of technology access and uses are derived from District B with limited and shared technology resources impacting the perceptions and attitudes significantly.

**Summary**

This mixed-methods research study examined technology’s impact on college and career readiness in two North Mississippi school districts. The quantitative aspect reported findings on the statistical significance between the two school districts on mean ACT® composite and subscores for English, math, reading and science. An independent t test was used to test each of the five hypotheses. The qualitative component reported perceptions and
attitudes of technology access and integration, technology impacts on college and career readiness, and technology implications on student performance of standardized tests. These data emerged from document analysis, administrator and teacher interviews, and 2014 high school graduate focus group meetings. The concurrent triangulation mixed-method strategy used in this study provided quantitative and qualitative findings to better understand technology’s impact on college and career readiness.
CHAPTER V

SUMMARY, CONCLUSIONS, RECOMMENDATIONS, AND IMPLICATIONS OF THE RESEARCH STUDY

College and career readiness is at the forefront of educational reform in the United States. In 2014, only 26% of high school graduates who took the ACT® in the nation met the college and career readiness benchmarks for all four subjects (ACT, Inc., 2014d). In Mississippi, 12% of the 2014 high school graduating cohort met the college and career readiness benchmarks for all four subjects (ACT, Inc., 2014c). These results initiate concerns for preparing today’s students for success beyond high school. Both federal and state level policies are driving a defined focus on college and career readiness. States are adopting or developing content standards and accountability measurements aligned to college and career readiness indicators to meet current federal mandates. Next-generation assessment, high-stakes test administered through technological mediums, are being implemented across the nation during the 2014-15 school year. The changes in standards, assessment, and accountability will impact curriculum and pedagogy, placing huge shifts in teaching and learning. Technology’s role in these shifts is vital to current and future teaching and learning practices.

Currently, school investments in technology confirm there are beliefs that technology enhances teaching and learning (Bebell & O’Dwyer, 2010; Bebell et al., 2010). Past research, however, indicated mixed or unreliable results stemming from the possible complexities of examining technology access and integration on student achievement (Bebell, et al., 2010; Holcomb, 2009; Spires et al., 2011). Concerns emerging from past research initiatives include
equating technology access and integration (Bebell & O’Dwyer, 2010; Bebell et al., 2010; Holcomb, 2009). Other developed issues include assessment alignment in measuring learning outcomes supported by technology access and use (Bebell et al., 2010; Holcomb, 2009) and ranging variations of how technology is integrated in teaching and learning (Dunleavy et al., 2007; Norris & Soloway, 2011; Norris et al., 2011; Rosen & Beck-Hill, 2012; Spires et al., 2011). According to the literature, a variety of concerns provided a need to continue research in the arena of technology’s impact on student achievement.

Emerging shifts in educational teaching learning practices and mixed results of past research on technology’s impact student achievement demonstrated a need to examine technology access and integration on college and career readiness indicators. The purpose of this concurrent mixed-method study was to examine the impact of technology access and integration on current college and career readiness for two rural North Mississippi school districts. The quantitative process examined mean differences on the ACT® composite and subscores in English, math, reading, and science between the school districts represented by each 2014 graduate cohorts. The qualitative approach explored district perspectives and attitudes on technology’s impact on college and career readiness. Quantitative and qualitative methods were used in this triangulation approach to answer six research questions and five hypotheses. Hence, the results of the two approaches are discussed through a comparison of the data.
Summary of the Research Study

Quantitative Summary

The mean of the District A’s ACT® composite score was .89, 95% CI [0.09 to 1.70] higher than the mean of the District B’s ACT® composite score. The results for Hypothesis One indicated there is a significant difference at the .05 level in 2014 graduate cohort student achievement based on mean composite scores on the ACT® between the two districts representing different levels of technology access and integration, *t*(555.067) = 2.189, *p* = .029.

The mean of the District A’s ACT® English score was 1.55, 95% CI [.49 to 2.60] higher than the mean of the District B’s ACT® English score. The results for Hypothesis Two indicated there is a significant difference at the .05 level in 2014 graduate cohort student achievement based on mean English scores on the ACT® between the two districts representing different levels of technology access and integration, *t*(552.146) = 2.878, *p* = .004.

The mean of the District A’s ACT® reading score was 1.03, 95% CI [.08 to 1.98] higher than the mean of the District B’s ACT® reading score. The results for Hypothesis Three indicated there is a significant difference at the .05 level in 2014 graduate cohort student achievement based on mean reading scores on the ACT® between the two districts representing different levels of technology access and integration, *t*(556) = 2.132, *p* = .033, *d* = .18.

The mean of the District A’s ACT® math score was .323, 95% CI [-.435 to 1.08] higher than the mean of the District B’s ACT® math score. The results for Hypothesis Four indicated there is not a significant difference at the .05 level in 2014 graduate cohort student achievement based on mean math scores on the ACT® between the two districts representing different levels of technology access and integration, *t*(556) = .837, *p* = .403.
The mean of the District A’s ACT® science score was .821, 95% CI [.02 to 1.62] higher than the mean of the District B’s ACT® science score. The results for Hypothesis Five indicated there is a significant difference at the .05 level in 2014 graduate cohort student achievement based on mean science scores on the ACT® between the two districts representing different levels of technology access and integration, \( t(556) = 2.061, p = .044, d = .17 \).

**Qualitative Summary**

The overall guiding research question for this research study was as follows: How do different levels of technology access and integration in high school learning experiences impact student readiness for academic and career experiences beyond high school? Four other research questions correlating with each research hypothesis are also explored. Four themes developed from the qualitative analysis: (a) perceptions and attitudes on levels of technology access, and (b) levels of technology integration, (c) technology access and integration implications of college and career, and (d) technology access and integration implications on standardized test. The themes provide an exploration of technology access and integration impacts for high school graduates successes beyond high school.

**Perceptions and attitudes of District A.** The perceptions and attitudes of District A represented high levels of technology access. Substantial amounts of technology hardware and software availability were documented throughout the years as well as overwhelming references of technology access from stakeholders. Perceptions of technology integration levels were at both the enhancement and transformation stages. Teaching and learning experiences were described at both the substitution and augmentation stages of Puente'dura’s (2008) SAMR model indicating technology integration at the enhancement stage. Technology integrated stages of Puente'dura’s (2008) model were also expressed at the modification and
redefinition stages indicating transformational uses. There were optimistic connections for technology access and integration impacts on college and career readiness with mixed findings on technology’s implication on standardized test. Overall, there was a consensus that technology had a valued impact on student successes beyond high school. Educators suggested technology as having a valuable impact on student performance on standardized test. However, students did not overwhelmingly corroborate this sentiment.

**Perceptions and attitudes of District B.** The perceptions and attitudes of District B represented low levels of technology access. There were few documented references to technology hardware and software access. Educator and student perspectives of access demonstrated limited or shared access to adequate technology resources. Perceptions of technology integration levels were mostly identified at enhancement stages with only transformational levels being met through courses heavily dependent on technology. There were encouraging connections for technology access and integration impacts on college and career readiness with mixed findings on technology’s implication on standardized test. All stakeholders demonstrated a need for technology access and integration experiences to better prepare students in college and career. However, there was no consensus of technology access and integration impacts on student performances on standardized tests. There was agreement between educators and students that there was a possibility technology could improve student performance but not necessarily for all students.

**Conclusions in the Research Study**

The results of the research study indicated statistical significant differences on student achievement for four (composite, English, reading, and science) of the five ACT® scores
between 2014 graduating cohorts representing two different levels of technology integration and access. However, effect sizes were very small and the confidence interval widths suggested a possible effect exists, but more information is needed to support a practical significance (Morgan et al., 2013). This conclusion is supported by the quantitative results.

District A had higher mean ACT® scores with a significant difference for the composite, English, reading, and science over District B. District A’s perception and attitudes were more positive toward technology access with more transformational levels of integration than District B. Equality of access to technology for all students eliminates socioeconomic disparities and provides more opportunity for technology integration at both enhancement and transformational levels. District B’s perceptions and attitudes demonstrated frustrations for lack of access and support for the current technology. Such limited access provides little opportunities for technology integrated teaching and learning experiences.

However, even with District A’s expansive access, District A had challenges with 1:1 access and integration as indicated by administrators, teachers, and students. An issue of appropriate use of the laptop by students was an overwhelming element impacting teaching and learning for District A. Students particularly indicated high levels of responsibility to use the laptops appropriately. District A voiced that all students were not prepared for this responsibility and implementation of the 1:1 initiative; therefore, positive teaching and learning experiences did not necessarily align for all students. Different levels of technology access and integration supported the statistical differences between the two districts. However, the lack of practical significance was substantiated by the voiced 1:1 appropriate use challenges in District A.
District A and District B demonstrated positive connections between technology and performance on standardized tests from teachers and administrators. District A administrators and teachers believed test scores improved due to more immediate formative data for teachers and students supported by technology as well as more opportunities for deeper learning experiences. District B administrators and teachers believed more access to individualized testing preparation resources and tools supported by technology strengthened improvement for student performance on standardized tests. However, student perspectives from both districts indicated the probability of little or no impact on student performance on standardized test scores. This mixed finding between educators and students corroborates the statistical findings that a significant difference was found between District A and District B on the ACT® composite, English, reading, and science scores but with little practical significance.

Student achievement in ACT® math scores had no significant difference between the two groups. This statistical result is validated by the qualitative findings. Perceptions from District A and District B demonstrated specific concerns toward access and integrating technology in math subjects. District A math teacher suggested technology was often used to “substitute for student understanding” (M. Smith, personal communication, February 13, 2015). The teacher claimed using technology to build deeper understanding was more appropriate; however, if a calculator is only being accessed and integrated to find the right answer, suspicions of little to no learning arises. This perception indicated possible dependencies on technology as a hindrance to student learning. A District B math teacher suggested the dependency on the graphing calculator had a specific negative effect on ACT® scores. “When they’ve come so dependent on the calculators they’ve lost that number sense and they can’t answer those questions” (N. Jacobs, personal communication, February 24, 2015).
District B students supported this claim by describing how they had used calculators from eighth to 12th grade, but “I’m in college and we don’t get calculators, I don’t know how to do basic things” (A. Hughes, personal communication, February 24, 2015). These perceptions supported the statistical finding, indicating no significant difference between the two districts for mean score on the ACT® math assessment. Technology access and integration through overuse and dependency of calculators have possibly curbed the learning in math subjects, suggesting detrimental results for all students.

Vast perception and attitude differences in technology access and integration between the two districts signified support of a significant difference in ACT® scores. Concerns from District A, including issues of appropriate use of technology, indicated challenges affecting the practical significance of the statistical findings and mixed findings between educators and students in both districts on technology’s impact on student performance on standardized tests. According to Districts A and B, historically, there has been an overwhelming use of calculators in math subjects. Both district perceptions indicated dependency on technology impeding student learning in this content area. Therefore, the lack of finding a significant difference in mean ACT® math scores was substantiated.

The overall guiding research question for this research study was the following: How do different levels of technology access and integration in high school learning experiences impact student readiness for academic and career experiences beyond high school? Both quantitative and qualitative findings verified different levels of technology access and integration in high school learning experiences have impacts on college and career readiness. In addition, District A described 1:1 teaching and learning environments supporting college and career because the
high school culture emulates skills and practices needed beyond high school. One District A student suggested:

Today's job market is extremely competitive. People are always looking for something to give them the upper hand. I feel like, kind-of the experience we have coming to college. . . I feel like we almost kind of have like, a prior training. And like I said, some people did abuse that, but if you use it the right way, the way it was meant to be used, then it really was beneficial to getting us to where we are now. (C. Taylor, personal communication, March 4, 2015)

Both educators and students in District A identified high school experiences with technology as beneficial to success in college and career. District B perspectives also supported college and career readiness but simply need further access and resources to effectively prepare students. A Principal from District B indicated:

We should give them [students] as much access as we possibly can. I think both access and integration are huge parts of preparing students for college and career either way. Just to be able to function in society today is to have a good understanding of how to use technology to their benefit. (T. Long, personal communication, February 5, 2015)

Although District B had limited technology resources, there was a consistent belief that access and integration in student learning would help students beyond high school. Students from both districts suggested more technology access and integration experiences as beneficial in preparing for college. Students requested more access and more use of technology in the form of learning management systems, communication tools and resources, research experiences, online classes, blended learning environments, collaborative projects, and presentations experiences. Even though there are substantial differences in technology access and integration between the school district in this study, there was an overwhelming consensus from both districts that technology positively impacts student readiness for college and career.
Recommendation and Implications of the Research Study

Technology continues to be an educational consideration for impacts on teaching and learning. Technology access and integration implication on standardized testing was currently shifting with the implementation of next-generation online assessments during the 2014-15 school year. The research findings suggested online administration of high-stakes assessment might cause considerable concern for student performance on standardized tests within different levels of technology access and integration. Both District A and District B voiced insecurities in administration of online testing. These insecurities mostly stemmed from lack of practice and experiences with online assessments. The levels of insecurities will be directly compounded for school environments with limited or shared access and integration. Future research should explore different levels of technology access and integration on student performance of online administered standardized tests.

According Holcomb (2009), “. . . existing standardized assessments may be ill equipped to measure 21st century learning . . .” (p. 54). Bebel et al. (2010) also suggested that, “because standardized tests attempt to measure a domain broadly, standardized test scores often do not provide measures that are aligned with the learning that may occur when technology is used to develop specific skills or knowledge” (p. 42). This past research indicated current standardized tests as improbable when measuring skills developed or strengthened by effective technology access and integration. As shifts in educational practices become more common for alignment to college and career readiness standards and assessments aligned with these standards are normed, research studies examining technology access and integration on student achievement should be replicated.
As indicated in other research studies, confusion between technology access and integration leads to mixed or unreliable results when examining student achievement (Bebell et al., 2010; Holcomb, 2009). Levels of technology access and integration were defined and explored through the qualitative approach of this study. However, for future research, other measurements of technology access and integration would help validate study findings when examining student achievement based on standardized test scores.

The study findings demonstrated no significant statistical difference between the two levels of technology access and integration represented by each district for math. The emerging data in this study revolved around calculators as a negative impact on student math achievement for all students supporting lack of statistical difference. However, Holcomb (2009) suggested in her review of past research that the possibilities of insignificant or low impact findings in math achievement for 1:1 laptop schools were due to “the fact that math was the content area in which laptops were used least frequently” (p.51). The lack of exploration in the use of technology beyond the calculator in this study and Holcomb’s suggestion indicate further research should investigate technology access and integration beyond calculator use for significant impacts in math content areas.

Recommendations for further research were indicated due to current educational reform movements including standards alignment to college and career readiness as well as changes in high-stakes assessment to measure those standards. Next-generation assessments are standardized tests given through technological mediums. This study examined technology access and integration impacts on current standards and assessments. Other recommendations stem from past research concerns—most directed toward a more developed exploration of technology integration in all content areas, but more specifically for math. Further research is
needed to continue examining technology’s impact on teaching and learning to best inform and improve decision-making options to ensure that students today are prepared for college and career. As technology continues to advance and frame daily subsistence, its presence in education will strengthen and grow. Examining current technology trends maintains this development and growth by identifying appropriate access and effective integration to support technology’s full potential in teaching and learning.
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APPENDIX
APPENDIX A

APPROVAL OF THE INSTITUTIONAL REVIEW BOARD
OF THE UNIVERSITY OF MISSISSIPPI FOR RESEARCH STUDY
Dear Ms. Peel:

This is to inform you that your application to conduct research with human participants has been reviewed by the Institutional Review Board (IRB) at The University of Mississippi and approved as Expedited under 45 CFR 46.110, Category 7.

Research investigators must protect the rights and welfare of human research participants and comply with all applicable provisions of The University of Mississippi's Federalwide Assurance 00008602. Your obligations, by law and by University policy, include:

- Research must be conducted exactly as specified in the protocol that was approved by the IRB.
- Changes to the protocol or its related consent document must be approved by the IRB prior to implementation except where necessary to eliminate apparent immediate hazards to participants.
- Only the approved, stamped consent form may be used throughout the duration of this research unless otherwise approved by the IRB.
- A copy of the IRB-approved informed consent document must be provided to each participant at the time of consent, unless the IRB has specifically waived this requirement.
- Adverse events and/or any other unanticipated problems involving risks to participants or others must be reported promptly to the IRB.
- Signed consent documents and other records related to the research must be retained in a secure location for at least three years after completion of the research.
- Submission and approval of the Progress Report must occur before continuing your study beyond the expiration date above.
- The IRB protocol number and the study title should be included in any electronic or written correspondence.

If you have any questions, please feel free to contact the IRB at (662) 915-7482 or irb@olemiss.edu.

Sincerely,

Ashley S. Crumby, PharmD
IRB Member
APPENDIX B

LETTER TO DISTRICT FOR RESEARCH STUDY PARTICIPATION APPROVAL
12/15/14

In an interest to support research in the field of K-12 education, as Superintendent of XXXXX, upon University of Mississippi IRB approval, I am consenting my district to participate in Randi N. Peel’s research study. I understand the research will work with previous identifiable student data (that will be de-identified), and include interviews with district and/or building administration as well as teachers.

Participation in Randi N. Peel’s research study will be confirmed upon University of Mississippi IRB approval and through a formal consent form before any data collection takes place.

*Name

______________________________

Date

______________________________

* XXXXX – represents name of school district

*Name – Superintendent Signature
APPENDIX C

STUDENT FOCUS GROUP QUESTIONS
STUDENT FOCUS GROUP QUESTIONS

1. What are your attitudes toward technology access and integration in high school in reference to your first-year college and/or career experiences beyond high school?

2. In what ways were your high school learning experiences enhanced or transformed by technology? Provide specific examples of technology integrated learning experiences.

3. What are your perspectives of technology access and integration implications on success in college and/or career pathways? Describe skills or strategies learned in high school that have carried over to support your first year beyond high school.

4. How can technology be better used to support high school experiences to better prepare students for college and career?

5. Describe your beliefs concerning technology’s impact on your performance on standardized tests.
VITA
Randi Nicole Peel

Education
Specialist of Education, Educational Leadership (May, 2005)
University of Mississippi, Oxford, Mississippi

Master of Education, Instructional Technology (August, 2000)
Mississippi State University, Starkville, Mississippi

Bachelor of Art, Journalism (May, 1993)
University of Mississippi, Oxford, Mississippi

Professional Employment
Instructional Technology Coordinator, Tupelo Public School District, 2014 to Present

Assistant Principal, Milam Elementary, 2013 – 2014

Assistant Principal, Tupelo High School, 2010 – 2013

Academic Presentations
International Society Technology Education Conference, Co-Presenter, Digital Photography for Connected Learning, 2014

Mississippi Educator Computer Association Conference, Co-Presenter, Google Apps Enhancing the Tupelo Experience, 2014

Northeast Mississippi Community College Mobile Conference, Presenter, Technology Integration: Purposeful and Intentional Implementation, 2014

Mississippi Educator Computer Association Conference, Presenter, iCreate the Future: The Tupelo Experience, 2011