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Dismantling Digital Inequalities: Urban High School Students' Perspectives of Smartphones Use in Education

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DISMANTLING DIGITAL INEQUALITIES: URBAN HIGH SCHOOL STUDENTS' PERSPECTIVES OF SMARTPHONES USE IN EDUCATION

A Dissertation Presented
by
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ABSTRACT

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The purpose of this research is to evaluate the use of and the attitude towards smartphone technology for in school and remote learning by urban high school students to reduce digital inequalities. High school students use smartphone technology in today's society as an integral part of their lives. Yet the majority of the large school districts in the United States ban the use of students' mobile phones in schools. Furthermore, while policy makers, school district personnel, and school administrators each year negotiate the school's technology budget, technology use agreements, network maintenance, and which Internet application tools to adopt, almost all students are bringing into schools an advanced computing technology device that imposes no additional cost to the school, the district, or the

state. More consistently than pencils, papers or even textbooks, students bring their smartphones into schools every day. But rather than enhancing ways to incorporate students' smartphone technology into the school's curriculum and instructions, school districts around the country have developed policies and procedures to prohibit or strictly monitor their use in the schools. This research project was conducted from a Culturally Responsive Computing (CRC) theoretical framework using the culturally responsive teaching lens to examine technology use, technology education, and technology accessibility from students' perspectives. The study involved a quantitative design methodology using an online web survey which explored students' use and attitudes in three areas: usefulness of smartphones for school, students' beliefs and understanding of smartphone policies in school, and how smartphones for student enables connections. In addition, three open-response questions within the survey were analyzed using qualitative design coding methodology to identify emerging themes.

DEDICATION

This paper is dedicated to my wife Jeanean Jozette, my daughter Kira Ayanna (beautiful flower), and my son Artis Akin (brave warrior) who God has given me as family.

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CHAPTER 1

INTRODUCTION

"Education is the most powerful weapon which you can use to change the world." -Nelson Mandela

Introduction

Public school systems continue to grapple with how the emergence of various personal smart technology devices should be or can be used as an effective educational tool (Gao et al., 2016; Mupings, 2017). Digital mobile devices, in particular smartphones, are an intimate part of a high school student's life. In the United States for example, based on a Pew Research Center study in 2018, 95% of American teens have access to a smartphone, up from 73% surveyed in 2015; 45% of those teens indicate they are online constantly (Anderson & Jiang, 2018). Developing ways to effectively integrate mobile phone technology within lessons that can engage students and enrich their learning experience in the classrooms will take a paradigm shift from traditional teacher-centered instruction (Keskin & Metcalf, 2011). But to accomplish this, instructional designers and teachers need more guidance on how to utilize emerging mobile phone technologies and applications as a teaching and learning tool. Furthermore, researchers and curriculum developers need to develop or use a solid theoretical framework which can guide effective instructional design and evaluate the quality of programs that rely significantly on mobile technologies (Park, 2011). Recent discussions around technology and education are rooted in personalization,

individualization, and student-led engagement to support student academic achievement, yet school-based technology use rules, regulations and teacher resistance remain central to how digital technologies and students' personal smart devices are accepted in schools (Selwyn & Bulfin, 2016). Through my research, I will examine the attitudes of students on the smartphone technology use for education. It is my belief that a shift in smartphone use policies in school can potentially generate opportunities to recreate, redesign or repurpose, on a broader scale, the technology culture around mobile phone use for educational purposes while sustaining culturally relevant pedagogy practices.

Statement of the Problem

It is both confusing and concerning that mobile phone technology, a widely available computing technology that can be used as an educational equalizer (Frederick, 2007), is banned from use in many of our nation's schools. Almost all the students in our nation's high schools have a smartphone, but very few have computers or web tablets (Anderson & Jiang, 2018). In urban schools, teachers and administrators spend too much time enforcing cell phone ban policies set by the district instead of embracing this individualized technology as part of the students' educational experience (Selwyn & Bulfin, 2016; Charles, 2012; Obringer & Coeffey, 2007).

Rather than finding a way to embed students' cell phone technology into the school's curriculum or activities, many school districts around the country have instead developed policies and procedures to ban them (Obringer & Coeffey, 2007). Educators and curriculum providers have an opportunity to explore and create ways to embed mobile phone usage and applications within classroom assignments (Peck et al., 2015). I posit that when schools ban mobile phones, which play an integral role in student lives, they forgo the benefits of

connecting students with the learning process and reduce the potential for students to collaborate with each other and with teachers. Specifically, with Black and Brown students, mobile phone technology can be used as a learning vehicle to develop counternarratives to combat negative stereotypes, to support cognitive projects by providing applications for intervention, and to connect to other literary perspectives that do not dehumanize Black people (Frederick, 2007). Unfortunately, curriculum providers and educators have not intentionally created ways to embed mobile phone technology use into the classroom in such a way that it will provide engaging and relevant lessons that will better connect students to their learning (Peck et al., 2015)

In addition, with the rapid advancement of mobile technology and Internet applications, the mobile phone ban policies in urban high schools may actually serve to increase educational technology inequalities and the digital divide gap, rather than minimizing it. Because students are unable to use their own smartphone technology in schools. This became evident during the school districts' rapid response to remote learning during the start of the COVID-19 pandemic (Vogels et al., 2020; Chandra et al., 2020; Correia, 2020). Studies claim that students from higher socioeconomical family backgrounds who had access to desktop computers, notebook computers or web tablets were better prepared for the transition to remote learning than students from lower socioeconomical family backgrounds who primarily only had access to smartphone technology. However, students with smartphone technology where able to stay connected to school and participate in class via videoconference. Educators, curriculum providers, and school leaders could use the move to remote learning to learn more about how smartphones can be a valuable technology in education (Peck et al., 2015).

Purpose of the Study

The purpose of my research is to evaluate the use of and the attitude towards smartphone technology for in school and remote learning by urban high school students to reduce the digital divide, which not only includes having access to technology but also how one uses specific technology (Gonzales et al., 2020; Shoemaker et al., 2004). Just like computers, Chromebooks and other technologies provided by the schools, I believe that students should be able to use their own technology that they bring with them, whether that technology is a computer, a tablet, or their mobile phones. Smartphones can be an effective and integral part of students learning experience within and outside of school, just as smartphones are an intimate part of students' social life and culture. Identifying ways to integrate the use of smartphone technology into the learning experience will allow educators to leverage the social use of mobile phone technology by teens for educational purposes throughout the nation's high schools.

There is limited but growing empirical and qualitative research for the educational use and benefits of smartphones in schools. Many of the earlier studies focused mostly on distractions, negative academic effects, and problematic social issues of students' mobile phone use (Ariel & Elishar-Malka, 2019; Kwok et al., 2017; Preston et al., 2015). More studies are needed to examine whether smartphone technology can help close the educational inequities of the digital divide and how mobile phone applications can be a viable technology for educational purposes. Furthermore, additional examination of the disconnection of today's mobile youth culture with the educational system is needed; this research will provide that examination.

Rationale of the Study

Still prevalent today is the inequitable access to computers for students within both school and home environments (Vogels et al., 2020; Peck et al., 2015). Students from neighborhoods with highly resourced schools have greater access to computers and the internet than students from neighborhoods with low resourced schools. This inequitable access is evident in the frequency of computer as well as the integration of computer technology in class assignments. How Information and Communication Technology (ICT)[1] is being used is influenced by contextual factors and a complex interplay between technological and sociocultural variables (Harris et al., 2017). Technological variables examine how students access technology, use technology, and develop their current skills around technology while sociocultural variables include students' demographics, socioeconomic status, and cultural backgrounds.

The socioeconomic status of families plays a significant role in technology exposure for students. Harris et al. (2017) shows how students from higher socioeconomic neighborhoods are more exposed to school computers, reading, playing musical instruments, and vigorous physical activity at home while students from lower socioeconomic neighborhoods are more exposed to TV, electronic games, mobile phone and non-academic computer activities. But regardless of socioeconomic status and level of technology usability skills, over the last two decades teenagers has established a mobile youth culture that shapes the way today's younger generation communicate, socialize, past-time, entertain themselves and obtain information (Yan, 2018; Vanden-Abeele, 2014).

[1] Information and Communication Technology (ICT) are electronic devices that provides connection to telecommunications. This includes but not limited to mobile phone devices, the Internet, wireless networks, web tablets, smart devices, and other wireless devices.

With mobile youth culture, advancements in mobile technology have moved quickly over the last ten years but the educational adoption of their use is still lagging (Peck et al., 2015). This lag in technology integration in schools is not reflective of early education reformers working with technology. Adoption in the K-12 school environment was the aim of various collegiate and district educational programs in the computing technology early development phase. The objectives were to use technology to actively involve students in classrooms in the learning process, provide opportunities where students can learn at their own pace, provide lesson activities where students can explore and learn in a safe simulated mode, and to create classroom interventions for bilingual and disadvantaged students in the English language and mathematics skills (Chambers & Sprecher, 1980; Bitzer, 1973).

Now with today's smartphone technology, students can connect to each other and to online resources anywhere at any time using the Internet infrastructure. This ubiquitous learning (u-learning) capability provides unprecedented opportunity for innovative teaching and lesson activities whenever and wherever students need them (Park, 2011). In addition, various online educational applications and utilities are being developed each year. However, school leaders and teachers are at odds with students on when and how smartphone technology can be used in school settings (Selwyn & Bulfin, 2016; Peck et al., 2015).

Research Questions

During the period of remote learning due to the COVID-19 pandemic, I covered four math classes with juniors and seniors for one term. At the start of each class session, I usually ask an open chat question where students reply via chat and then we discuss their answers afterward. Questions ranged from "What is your favorite ice cream flavor?" to "Name one thing that annoys you, and why?". In one particular class session, I decided to

ask a question related to smartphones. I asked, “Have you ever got in trouble for using your smartphone in class?” To my surprise, in all four classes, every student replied ‘Yes’ to this chat question. I am somewhat embarrassed to say that my surprise was driven by the fact that they were the same students that my colleagues refer to as high achievers—i.e., the ‘smart’ students. In general, these are students who do not have behavior issues in school, yet they were getting in trouble for their smartphones as well. Given the overwhelming replies of ‘Yes’ from the students, I was eager to understand how they were getting in trouble. “Trouble” ranged from a verbal reprimand to being removed from class. Some of the students talked about their families being contacted just because they were checking the time on their own mobile phone.

The discussion went on to include what students were actually doing on their phones when they got in trouble. The students indicated that most of the time they were checking the time, looking at notifications or trying to do something related to schoolwork on their phones. And after addition questioning, some students did indicate occasionally going on their social media accounts. This begged the question, why is it that when students bring their own notebook computers or web tablets to school and use them in class, it is not an issue? But, when students use their personal mobile phone technology in schools, they are criminalized, i.e., getting in trouble, for doing so? And what if the smartphone is the only working technology the student has at that moment? Is it that we—as district leaders, school leaders, administrators, and teachers—are setting aside the mobile youth culture in schools when every day we are using mobile phone technology to manage our own day-to-day responsibilities?

As indicated in the literature review, most studies related to mobile phone use policies and potential benefits in schools were developed from the adult perspective (Kates et al., 2018; Wentworth & Middleton, 2014). The research angle tended to be around mobile phone use by students as a distraction that causes low assessment scores and lack of student engagement. I explored this topic from students' perspectives not only as prominent users of smartphones but also as central participants in school. My primary research questions for this study are:

- To what extent do urban high school students believe smartphone technology can be useful in school and during remote learning?
- How do urban high school students perceive smartphone ban policies in schools?
- How do the attitudes about smartphone use in school and remote learning of urban high school students differs within the different gender, race/ethnicity, grade level, and technology ownership status?

This research project was conducted from a Culturally Responsive Computing (CRC) theoretical framework using the culturally responsive teaching lens to examine technology use, technology education, and technology accessibility from the student's perspective. Under the revised CRC tenets lens, I invited high school students as participants to join me in this research. It was the perceptions, attitudes, and beliefs of students that guided this study because it is our students who are mostly affected by smartphone school policies.

The hope is that these questions examined within the revised CRC tenet would specifically provide insight to the indicators that students are capable of defining and creating new smartphone technology feature needed for education, students are finding ways to

interchange smartphone technology from social use to educational use, students can self-define their personal needs for smartphone technology, students are able to use smartphone technology to promote their identities and counter perceptions, and students are capable of using smartphone technology for academic success. My hope with these findings is to provide an opportunity for Black and Brown urban school students, who are typically left out of the conversation, to join the discussion and the decision-making process related to smartphone use polices in urban schools.

Positionality Statement

I am an African American male, born and raised in the Fort Lauderdale, Florida, in Broward County. First, I acknowledge my American ancestorial roots that I can partially trace for three generations on both my mother and father side in Screven, Bullock, and Burke counties in the state of Georgia. It is through their sacrifice, teachings, love and support that is a part of who I am today. Being the youngest and only male with two siblings, I grew up in a family with working parents who still had to receive government assistance to support the family. I am the only one in my immediate family, and one of two in my larger extended family who successfully completed college. I am married with two children. I am a Christian who observes the Sabbath.

I have always been intrigued by technology and electronic devices. As a child, my first awareness of technology was a radio-controlled car and an electric train set. My curiosity moved me to disassemble both toys and put them back together again. After that, I was always called upon by the family members to "fix" or program electronic devices like VCRs, radios, and cassette players. This was paralleled since as long as I can remember with my love for teaching and tutoring other with their schoolwork. However, my continual

technology interest later led me to change my major in college from math education to electrical engineering which led to fourteen years of experience in two Fortune 500 technical companies. While there, I developed, designed, produced, and promoted mobile phone semiconductor technology, for set-top boxes, end-user mobile devices and the cellular infrastructure.

After fourteen years working on leading-edge technology for mobile phones and traveling around the world, I transitioned back to my first love; serving as an educator. In my various roles of teacher, instructional leader, and administrator staff within an urban school that serves almost all Black and Brown students, I strive to support the whole child by negotiating my actions inside and outside organizational boundaries. Although school operates within certain autonomies, such as hiring practices, curriculum selection, and student behavior expectations, our school and our actions within those autonomies are still governed by procedures, policies, and laws as defined by the school district, the city, the state, and the federal government. It is my continual desire to act as an education reformer at the school and district levels. I strive to better understand the disconnect between what educators believe they bring to the classrooms to engage and inspire students versus what students believe they need to succeed in school and beyond. As a Black male high school math teacher with an engineering background and experience working at technical companies, I often struggle with two competing perspectives: finding a balance between adherence to a ban on cell phone use in class with my students and my fundamental belief that technology can enhanced our lifestyle and provide access to multiple facets of our society.

Significance of the Study

Studies show that mobile technology use has increased significantly over the last two decades within traditional brick and mortar classrooms, rural remote learning environments, and in professional and trade organization training programs (Peck et al., 2015; Pedro et al., 2018). The technology usually consists of web tablets or computer notebooks provided by the organization, not necessarily the individuals' personal mobile phones. However, mobile phones are becoming the default technology tool in some countries. For example, India and multiple countries in Africa that have less developed infrastructure in remote rural areas are increasingly exploring ways to use individual personal mobile phone devices for learning due to the availability of multiple applications, its lower cost, and the country's existing communication infrastructures (Osakwe et al., 2016; Keskin & Metcalf, 2011; Maphalala & Nzama, 2014). However, in the K-12 urban schools in the United States, smartphone technology use for education is banned or strictly monitored, thereby allowing technology inequities to continue to increase. In other words, students are not being allowed to use their technology of choice such as their smartphones which can be the only computing technology their family owns.

The implications of my study are trifold. First, by examining the impact of mobile phone policies in high schools through the lens of the digital divide, I can provide education policy makers and school leaders with insight on whether such policies hinder or support the technology inequalities in education. A significant number of studies are published on the negative effects of youth mobile phone use such as addiction, sleep deprivation, cyberbullying, and distractions, but very few look at the educational advantages within the mobile youth culture (Ariel & Elishar-Malka, 2019; Kwok et al., 2017; Preston et al., 2015).

Examining the educational advantages more may lead to a modification of smartphone use policy in schools that better reflect today's youth (Peck et al., 2015).

Secondly, Black and Brown students in urban schools from lower socioeconomical families depends on their smartphones as the primary technology, and in most cases the sole technology, for communication, social interaction, to pass time, to obtain information, and for entertainment (Scherer and Siddiq, 2019; Vanden-Abeele, 2014; Warschauer, 2003). Despite policies that ban mobile phone use in schools and the lack of intentional lesson planning around smartphones, this study will examine how Black and Brown students, who are traditional marginalized even with the 'acceptable' educational technology options, are increasingly finding ways to utilize their smartphones for educational purposes.

And thirdly, the examination of smartphone use in education will add to the literature and dialogue on how personal technology devices allow traditionally marginalized students to directly connects to culturally responsive teaching. Furthermore, allowing smartphone use can help reduce the technology inequalities in education. Thus, the impact of the study reaches far beyond the classrooms and serves to further the dialogue on the intersectionality of race and technology in education.

Definition of Terminology

In this study, the terms cell phone, mobile phone and smartphone may be used interchangeably. However, cell phones usually refer to the earlier personal mobile technological devices used primarily for voice and text communications that were connected through the cellular wireless infrastructure. As the technology progressed and adoption increased with the younger generation, limited camera and video capabilities were added. Smartphones are advanced personal mobile technology devices that includes computer

applications, full multimedia capabilities, Internet browsers, financial applications, and many other personalized features for the user. Mobile phones can either refer to cell phones or smartphones; this term simply recognizes that these devices are small and portable, hence they move with the individual, wherever they go.

Mobile technology is a broader terminology that includes devices such as mobile phones, web tablets, notebook computers, and other smart devices that are small and portable (Kukulska-Hulme & Traxler, 2005).

Digital natives are individuals who grew up with digital technologies and smart mobile devices, i.e., the younger generation who are constantly on their smartphones. Alternatively, digital immigrants refer to the older generation who was first exposed to digital technologies later in life (Prensky, 2001).

Digital Quotient (DQ) score refers to the level of tech-savvy knowledge that an individual may have; digital natives tend to have higher DQ scores.

Information and Communication Technology (ICT) are electronic devices that provide connection to telecommunications. This includes, but is not limited to, mobile phone devices, the Internet, wireless networks, web tablets, smart devices, and other wireless devices.

Electronic Learning (e-Learning) is learning that is conducted on electronic media such as a desk computer, web tablets and notebook computers. Today, e-learning includes both wired and wireless devices.

Ubiquitous Learning (u-Learning) is learning via a mobile technology device that can take place anywhere or at any time. The technology is embedded in the background of the individual's daily life (Crowe, 2007; van't Hooft el al., 2007).

Summary

Smartphone technology has become a ubiquitous part of high school students' daily lives (Anderson & Jiang, 2018). Social media and online applications dominate their method of communication and social interactions. Schools cannot afford to continue lagging in embracing the preferred personalized technology used by the young generation (Peck et al., 2015). In particular, Black and Brown students who are traditionally marginalized in our education systems have greater social and personal dependency on their smartphone technology. Thus, examining policies that affect how and when students can use their smartphones in schools may shed some light on the digital divide and technology inequities in the classrooms.

CHAPTER 2

REVIEW OF THE LITERATURE

"The function of education is to teach one to think intensively and to think critically. Intelligence plus character–that is the goal of true education."
-Martin Luther King, Jr.

Introduction

Critical race theorists in education seek to understand the issues that arise from schools' disciplinary policies, structures, curriculum selection, and achievement testing to transform the relationships among race, racism, and power (Delgado & Stefancic, 2001). The integration of technology, including mobile technology like smartphones, within schools provides another aspect to examine the historical structural inequalities and institutionalized racism that plague our education system (Frederick, 2007). In the next section, I discuss culturally responsive teaching, also referred to as culturally responsive pedagogy, and how this framework set the foundation for culturally responsive computing tenet. I will follow this by reviewing the tenets of the culturally responsive computing theoretical framework that were derived from the original work of critical race theorist in education. Next, I will examine three other bodies of literature I categorized for this study: first, I examine the evolution of technology implementation in K-12 schools in the United States and its intended impact on student achievement; secondly, I examine the digital divide and digital inequalities

that are persistent in the education system; and finally, I examine the effects of mobile phone use policies in urban high schools.

Theoretical Frameworks

Culturally Relevant/Sustaining Pedagogy

Gloria Ladson-Billings (2014) revisited the Culturally Relevant Pedagogy theoretical framework and renames it Culturally Sustaining Pedagogy because the fluidity and variety within cultural groups seemed to get lost or become static when researchers cited, or practitioners used, the original work in teaching and learning. "What state departments, school districts, and individual teachers are now calling 'culturally relevant pedagogy' is often a distortion and corruption of the central ideas I attempted to promulgate" (Ladson-Billings, 2014, p. 82). Three domains drove Ladson-Billings' (2014) central ideas: academic success, cultural competence, and sociopolitical consciousness. The student's academic growth within the classroom is the result of instruction and learning experiences. The students can appreciate and celebrate their own cultures and languages while learning about others. They should also take the learning outside of the classroom to identify, analyze, and solve problems in their own communities. At one time, there were many educational reform efforts to incorporate social justice and equity within instructional pedagogy, however Ladson-Billings (1995) recognized that those efforts failed to accept and affirm the students' own cultures, nor did they teach students how to critically deconstruct and challenge the inequalities that schools and other institutions perpetuate. Educators did nothing more than perpetuate the inequities of marginalized students by developing strategies that fit students in the current hierarchy structure of society.

Culturally Sustaining Pedagogy –also referred to as Culturally Relevant Pedagogy 2.0 or the Remix– intends to address the needs of students in this century and to address the complexities of social inequalities. Building upon the original ideas of Culturally Relevant Pedagogy, the remix aims to: 1) incorporate the multiplicities of identities and cultures that help formulate today's youth culture; 2) revitalize, reclaim, and restore languages and cultures of people who have faced systematic extinction; 3) ensure those in the mainstream develop skills to critique the very basis of their privileges and advantages, and; 4) recognize the ability to meet the needs of external performance assessments as well as community- and student-driven learning without diminishing either (Ladson-Billings, 2014; Giroux & Simon, 1988; 1989; Paris & Alim, 2014; McCarty & Lee, 2014). Ladson-Billings (2014) recognizes that scholarship is fluid and popular culture changes from generation to generation. So, new studies are created to reflect and respond to the change in time. As technology continues to evolve, this perspective points to the need of additional educational studies to examine how the culturally relevant use of personal mobile devices in schools should reflect today's youth.

Culturally Responsive Teaching

Building upon the aims of Culturally Sustaining Pedagogy, Culturally Responsive Teaching is an instructional strategy that considers students' cultural and linguistic backgrounds (Ladson-Billings, 2000; Gay, 2010). Instead of using a deficit model, focusing on what Black and Brown students do not have, culturally responsive teaching promotes the idea of approaching educational strategies by starting with what students already bring to the classrooms, i.e., themselves as whole, complete and complex individuals. Scott (2015) explains that using the students' background to develop instructional strategies is one of the three interlocking essentials of culturally responsive teaching, which are reflection, asset

building, and connection. Culturally responsive teaching involves empowerment, transformation, validation, comprehension, multidimensionality, and emancipation (Gay, 2010). Furthermore, culturally responsive teaching proposes the notion that knowledge is not static; rather, knowledge is constructed and must be viewed critically. In addition, assessment of knowledge must be multifaceted, which considers multiple forms of excellence (Ladson-Billings, 1995).

Culturally responsive teaching uses the personal experiences and the family background of students as an asset to their learning (Scott et al., 2015). In other words, it considers the student's heritage and social systems as a critical part of the school's curriculum and learning activities (Howard, 2003). Moreover, teachers must believe that all students are capable of academic success and students are not able to choose failure as an option (Ladson-Billings, 1995).

For culturally responsive teaching to be effective, "teachers are seen as instrumental in the process of effectively implementing culturally responsive teaching by creating an integrated learning context" (Scott et al., 2015, p. 414). To accomplish this, teachers must be aware of how their biases, world views, and experiences influence what lesson content, materials used, and even technology are acceptable or effective in the classroom, specifically for traditionally marginalized Black and Brown students (Pang, 2009). Oftentimes, teachers of Black and Brown students have worldviews that are drastically different from the students in their classrooms (Howard, 2003). Teachers must help students "recognize, understand, and critique current social inequities" (Ladson-Billings, 1995, p. 476). This can only be accomplished when teachers recognize this themselves.

As teachers continuously reflect on their cultural competency, culturally responsive teaching calls for teachers to build lessons to connect with their students' identities (Gay, 2010; Howard, 2003; Ladson-Billings, 2000). These connections will not only engender authentic and sustainable relationships with Black and Brown students, but also foster within students a belief that they will succeed both academically and socially. In addition to teachers building effective relationships with students, teachers should encourage students to work collaboratively to help one another as a community and demonstrate a connectedness with all students (Ladson-Billings, 1995).

Culturally Responsive Computing

The tenets of a Culturally Responsive Computing (CRC) foundation are rooted within the culturally responsive teaching theoretical framework (Scott et al., 2015). CRC theoretical framework examines how Black and Brown students engage with technology for educational purposes by using the culturally responsive teaching approach to examine how technology use, technology education, and technology accessibility can be viable tools for all students (Gay, 2010; Ladson-Billing, 2000; Scott et al., 2015). To expand this theoretical concept, I examine how students are impacted by the policies and perceptions of smartphones use in schools. Just as CRC has been applied "as a heuristic for practitioners and researchers to ultimately address digital disparity by considering intersectionality, innovation, and community advancement", I apply CRC to examine smartphone technology use in schools (Scott, 2015, p. 413). Because students' personal use of their smartphone has become an intimate part of their lives, mobile phones are now a part of their culture.

Scott & White (2013) implemented the three interlocking essentials of CRC, which build upon standpoint theory. Standpoint theorists first seek to understand how traditionally

marginalized people view the dominant culture. Then, they document how that dominant culture practices its power. Finally, they develop ways to build upon their knowledge and assets to make social justice changes. This approach recognizes that marginalization should not keep students from pursuing their interest and vision with technology, from expressing their commitment to social justice activity, nor from advocating for their community. In addition, marginalization by the dominant culture should not depress students' belief in themselves (Scott & White, 2013). The three essential elements of culturally responsive teaching instructional practices are applied within CRC.

For asset building, Scott and White (2013) show how dialogue between teachers and students provide a space for students to understand what they already know about technology and about themselves. Information about the students' existing knowledge related to technology and other content areas are recognized and integrated in the learning process by the teachers. In terms of reflection, the students use dedicated time to reflect on how they came to their knowledge about technology and to challenge each other with respect to their identities and behaviors around technology. As for connectedness, students are encouraged to use their technological knowledge and the information they learn from their research to culturally connect with one another and their communities to bring about social change (Scott & White, 2013). This is a clear example of arranging culturally responsive education and social movement building into a mutually reinforcing relationship, bringing community members into educational practices, and facilitating teachers' classroom connections to the economic and social challenges faced by communities (Lachney, 2017). The practical applications of CRC's three essential elements are made possible through dialogue and critical evaluation throughout the learning process.

Michael Lachney (2017) notes that "CRC brings community knowledge and skills that might not be traditionally thought of as educational and might even be viewed through the deficit model as a barrier, to classroom practice" (p. 424). In this view, CRC is seen as a brokerage framework so that through students, culturally responsive education can focus on community-based social movements for underrepresented communities as well as education reforms. Here the essentials of culturally responsive teaching (i.e., asset building, reflection, and connection) are mapped onto the three principals of brokerage which are identification, advocacy, and connectivity (Lachney, 2017; Scott et al., 2015). I argue that schools have an opportunity to work with the community to illuminate the ways that technology, including mobile devices, can motivate education-based social movement. Thus, students can be "brokers" between schools and school districts on the utilization of mobile phones for educational purposes.

Scott et al. (2015) reframes CRC using five tenets to consider how the advancement of digital technology and technology education can be reflected upon while simultaneously considering students' cultural backgrounds and social experiences. The first tenet is that all students are capable of digital innovation. In other words, many Black and Brown students use technology every day, either personally or at their jobs. As a result, they are not only capable of obtaining digital literacy, but they can become engineers and programmers who develop technology applications, as well. The second is that the connection with learning supports the transformational use of technology. Here, students are encouraged to find innovative ways to make current technology use beneficial to them and their learning. The third is that learning about oneself and how one relates to society promotes technological innovation. When students recognize the complexity of who they are as individuals, that

same complexity sparks the complexity of technology innovation. The fourth tenet is that the use of technology is a method in which students can learn about their intersectional identities. In other words, when Black and Brown students examine the way technology has been used to create negative perceptions of who they are, students are able to create counternarratives to those negative perceptions by using and manipulating technology. The fifth and final tenet is that the success of technology use should be measured by who the technology was designed for, and by whom it was created, not just by its culturally irrelevant broad use in lessons by Black and Brown students. This tenet calls for students to acquire the technological skills to dismantle the system that continues to marginalize Black and Brown students in STEM. It also provides a call for researchers to conduct more empirical and qualitative studies regarding technology use that looks at how marginalized students can use technology to support themselves and their communities.

Returning to the foundation of CRC, I revised the three tenets of culturally responsive teaching to be examined from the students' perspective instead of from the teachers' perspective. The intent here is to add to the limited number of empirical research related to smartphone technology in school that is centered on the student's voice. For the first tenet asset, I will examine smartphones as technology assets for students. For reflection, I will examine students understanding and reflection of school policies related to smartphone use. And lastly, for connection, I will examine how smartphones for student enables connections related to education.

It is from this lens, which I dubbed Culturally Responsive "Learning" (with Technology), I will examine to what extent does smartphone technology use can be utilized to enhance learning and remote learning to reduce the digital divide for Black and Brown

students in urban high schools? Furthermore, with this study, my hope is to continue to fill the gaps in research studies that critically examining whether mobile technology devices like smartphones can be a valuable asset to students' learning experience and process. But first, let's examine how technology in education has evolved over time.

Culturally Responsive Learning with Technology Theoretical Framework

Today's youth are born into societies where technology is being used in almost every aspect of their life, from life-saving medical procedures to on-demand entertainment programs. Infants are being introduced to portable electronic devices even before they have full control of their extremities. At all times throughout the day, teenagers utilize various computer applications to order food, to arrange for transportation, and to stay connected to their family and friends. Furthermore, social media applications and internet search engines are becoming the primary sources that today's youth are using to find answers to their questions, to find out what others are saying about specific topics, or to learn more about something they are not familiar with. So, whether in school or not, youth are learning and shaping their views by using their smartphone or personal computing devices to connect with information on the internet. Culturally Responsive Learning with Technology is a theoretical framework I describe as the students' perspective on how portable technology, more specifically smartphones, can be used to effectively enhance learning experiences, both within school and at home. Building upon the three interlocking essentials of culturally responsive teaching that Scott et al. (2010) describes (asset building, reflection, and connection) culturally responsive learning with technology considers how personal portable technology is being used as an asset by students, how important it is for students to understand and reflect on school policies that governs their use of personal portable

technology, and how personal portable technology used by students enable connections within an educational environment.

Students are already using smartphone technology as integral part of their social lives; the same technology asset can be used to enhance their education experience, as well. School districts and adult communities can consider shifting their perspectives to provide opportunities for student to utilize personal technology assets they bring with them to school. As a part of the digital generation, students are capable of determining how their personal portable technology can be beneficial to their learning in education. Students are early adopters of smartphone applications and are constantly using them. As technology continues to evolve, today's youth can help build upon their personal technology asset for use in education as well.

There are standing policies on technology use in schools that were not codeveloped by those who the policies effect the most, i.e., the students. Students are aware of the biases that exists concerning personal technology use in schools, and to understand that the views related to technology use of teachers and education policymakers may differ from theirs. By establishing opportunities where students can reflect on the intersectionality of personal portable technology use and their identities, I believe students will develop additional ways to excel academically and personally through the use of smartphone technology in education. In addition, relevant school-based policies on smartphone use can be aligned with the digital youth culture.

The use of personal portable technology provides connections far beyond social activities. Students are exploring ways to use their smartphones for school and community activities as well. The nature of portable technology allows students to make connections

without waiting for permission or being subject to outside controls; rather, portable technology enables students to connect to others, to information, and to resources from anywhere at any time. This form of technology freedom serves to awaken the sociopolitical consciousness of students that can help address educational and social inequities.

The Evolution from Computer Assistance Instruction to u-Learning

Computer Assistance Instruction Historical Perspective.

Before smartphone and personal computer technology became so prevalent, other types of technology were embedded in classrooms to enhance students' learning experience and to make problem solving more efficient. In the early 1970s and through the next decade, as computing technology began to make leaps and bounds in the engineering and scientific communities, others saw computing technology potential and usefulness in the classrooms as valuable enhancements to the educational process. Although cost was the primary factor that limited the widespread integration of technology in K-12 classrooms, private and governmental grants made it possible for several schools across the country to implement computer assisted instruction technology in schools (Chambers & Sprecher, 1980; Suppes & Morningstar, 1969; Hullfish & Pottebaum, 1971). In the United States, computer assisted instruction began in the late '50s and early '60s on the college campuses of Florida State University, Dartmouth, and Stanford (Chambers & Sprecher, 1980). While Florida State University developed physics and statistics computer assisted instruction courses and Dartmouth developed the Basic computer language for simplified ways to program computers, Stanford's computer assisted instruction "work represented the first attempt to increase children's skill level in basic English and mathematics through computerized drill and practice" (Chambers & Sprecher, 1980, p. 333).

Computer assisted instruction fit into one of two types of usage: Either the technology was used to supplement learning situations and lessons, or it was use as a substitute or stand-alone method of delivering the lessons. Computers were used "to provide course content instruction in the form of simulations, games, tutorials, and drill-and-practice" (Chambers & Sprecher, 1980, p. 332). The time required to implement and support the technology and the capability that was needed for the educational programs were driven by the simplicity-complexity level of the computer assisted instruction. However, several benefits were recognized during this experimental timeframe.

One of the widely accepted benefits of computer assisted instruction in the classroom was that students were actively involved in the learning process. (Chambers & Sprecher, 1980; Bitzer, 1973). The computer programs did not allow much room for students to be passive learners of the situation. For example, in the drill-and-practice mathematic program developed by Stanford University using a teletype machine, pace was determined by the student's response rate to answer the problem. The teletype machine printed each problem, then waited for the student to respond. Students were only allowed 10 to 40 seconds to respond to a question before the machine printed 'Time is up, try again' (Suppes & Morningstar, 1969).

Another benefit of computer assisted instruction was that students could learn at their own pace (Chambers & Sprecher, 1980; Bitzer, 1973). So, whether students were slow learners or fast learners, computer programs were used to immediately and systematically reinforce the content for all learners. At the same time, because students' responses on the computer can be stored, computer assistance technology can track the students' progress by "making it possible to reconstruct the actual learning sequence of any given student"

(Hullfish & Pottebaum, 1971, p. 83). For example, the Chicago City School Project in 1971 that provided computer assistance instruction tutorial lessons in mathematics and reading for fourth through eighth grade students had significant performance results (Chambers & Sprecher, 1980). In some content area where teaching staff was inadequate, computer-based instruction was primarily used. "Computer-based instruction can take over a good deal of the teaching of a foreign language" (Suppes & Morningstar, 1969, p. 350), especially for languages such as Russian, Japanese, and Chinese where staff for teaching these languages was not sufficient in K-12 schools.

Computer assisted instruction also provided opportunities for students to explore and to learn in a safe simulated mode. So, whether it was a simulated laboratory experiment with dangerous chemicals or investigating complex problems and methodologies, students were able to explore situations in time and space using computer assisted instruction (Chambers & Sprecher, 1980). In addition, as Hullfish and Pottebaum (1971) pointed out in their article on using computer assisted instruction in music programs, the ability to make "real" time decisions about what course material to present to students and to make modifications to lessons without reprinting hard-copies and textbooks is another advantage of using technology in the classroom.

Another benefit of using technology in simulation mode is that "the use of computers in this manner frees faculty members or training coordinators to devote more time to the personal, human considerations of their students" (Chambers & Sprecher, 1980, p. 333). In other words, teachers had more time to spend with their students to develop their students' creative and critical-thinking skills. The belief at that time was that students would learn more in a shorter time and that their innovative and creative side would have more time to

develop fully. This was seen in the Stanford University's drill-and-practice computer assisted instruction where Suppes and Morningstar (1969) pointed out that grades 4 to 6 teachers preferred to use computer-based program to review and manage the provision of math practice problems for the students, thereby freeing up their time to do other things.

Lastly, computer assisted instruction was used as an intervention for bilingual and disadvantaged students whose skills in the English language and mathematics were inadequate for entry level college courses (Chambers & Sprecher, 1980). Computer tutorials used for interventions were both educationally sound and reasonably priced to implement in classrooms. However, it is worth reiterating that the benefits of computer assisted instruction were not just for learners who needed more academic interventions but also benefited other students as well (Suppes & Morningstar, 1969). This benefit was also realized in continuing education and industrial training situations as well.

Unfortunately, computer assistance instruction is not without its detractors. According to Chambers and Sprecher (1980), there were three disadvantages of using computer assisted technology: (1) the need for teachers to change their accepted instructional methods to a new and relatively unproven method of teaching with technology, (2) instructional material that was poorly designed or not readily available for educational use, and (3) there was an added cost to implement. Because computer assisted instruction was new and most teachers had little experience working with technology in the classroom, teachers were afraid and disliked using it (Allen, 1972; Chambers & Sprecher 1980). Furthermore, there were various types of computing hardware and competing program languages with this new technology that were not readily available to educational programs and course materials. As John R. Allen (1972) stated, one of the most inhibiting factors of

using computer assistance technology at that time was “the interface problem: there is not yet enough standardization for a program written at one installation to be easily brought to another” (p. 48). There were only a few technical experts to support teachers during implementation, and most programs were developed for specific purposes. Lastly, the cost to utilize computer assisted instruction was seen as an added cost to the school because of the hardware, the course material, and the support personnel needed to use the technology. This last point became a major factor when computer assisted instruction was used to enrich the learning experience in the K-12 classrooms, not to replace it (Chambers & Sprecher, 1980).

Because the cost was high, the ability to initially embed technology in K-12 classrooms was made possible by grants from private philanthropists and government agencies. The National Science Foundation and agencies under the Elementary and Secondary Education Act of 1965 as well as private philanthropic foundations like Carnegie and Ford were all instrumental for the growth of computer assisted instruction in the classrooms (Atkinson & Wilson, 1968).

There were several studies made related to the future educational possibilities of computer assistance instructional applications. One prediction was that there will be widespread acceptance of educational technology by 1980 (Chambers & Sprecher, 1980). According to previous studies, this acceptance by teachers, content providers, and district leaders would occur after: the development of minicomputers with microprocessors that would reduce the space required to host computing devices and lower the hardware cost; the increase in electronic storage space through technology improvements; the increase of educational programs written by instructors working with teachers and students; the shift in implementation of computer assistance instruction that focus more on assisting the teacher in

the classroom rather than replacing the teacher; and the development of a satellite network for connectivity. (Fauley,1978; Alpert & Bitzer, 1970; Chambers & Sprecher, 1980; Allen, 1972; Bitzer, 1973).

But here we are, more than four decades later, still grappling with the same three challenges as teachers struggle with embracing mobile technology in the classrooms. Smartphone technology is the embodiment of those future computing hardware and software predictions. The processing power and memory capability support multimedia applications as well as personal utilities functionality. Also, smartphones are portability and can be constantly connected to the Internet via WiFi and cellular services. And smartphone technology is widely used by the younger and older generations. However, teachers and administrators are skeptical about using smartphones in schools for educational purposes; curriculum and instructional material development for smartphone applications is lagging; and smartphone network connectivity and maintenance reliability can be negatively impacted by a family's lower socioeconomical status.

The Evolution to m-Learning and u-Learning

As the natural evolution from computer assistance instruction technology, mobile phone technology could become that educational tool whereby students can be more efficient and engaged in school activities anywhere, anytime. Mobile phones could connect students with teachers to get their work completed and graded in a more efficient way. With today's application technology, cell phones could keep track of students' assignments and manage the submission of student work. In class, students could use mobile phone applications to submit their answers to questions in real-time, thereby allowing teachers to use a web-based software tool to display the results to the whole class or to record the students' score

efficiently in their electronic gradebook. In addition, mobile phones could become an effective way for students to receive feedback from their teachers. Various types of questions, problem-based learning, and multimedia lesson activities could be easily and efficiently implemented in the classroom using mobile phones, requiring little to no additional investment in other technology resources (Ott et al., 2017; AlTameemy, 2016; Kim & Smith, 2017; Li & Yang, 2016; Kalloo & Mohan, 2011).

Cell phones are one of the typical devices used for m-learning around the world (Park, 2011; Maphalala, 2014; Sharple & Vavoula, 2007). While earlier studies focused on m-learning as an activity taking place outside of traditional classrooms, the increase of students with cell phones in schools has challenged the definition of m-learning and use of m-learning technologies. Currently, the pedagogical considerations to embed cell phone use in the classroom are limited and are still in the infancy stage (Katz & Aakhus, 2002; Brown & Green, 2001; Spitzer, 2015; Tingir et al., 2017; Lai & Bower, 2020). Because of mixed empirical studies' results on general mobile phone use in classes, further studies are needed to determine how mobile phone use affects students' academic performance (Kates et al., 2018; Spitzer, 2015; Sung et al., 2016).

In Kalloo and Mohan (2011), a variety of mobile learning applications such as text-based lessons, tutorials, games, collaborations, and personalized recommendations are used to give students a choice in how they acquire knowledge for learning. Their results show that when mobile phones are used to drive learning strategies, it can lead to increased student performance. To build upon this research, educators can help develop applications that mirror how students use their mobile phones in social settings and then apply them within an educational setting. By doing this, the inequalities between curriculum and pedagogy and

between knowledge and explanation, that have been long embedded in the educational system, can be leveled, as Ellsworth (2004) points out. And because cell phone bans are an established policy in many school districts, discussions are needed between education policy makers, district leaders, teachers, students, parents, school leaders, app designers, and curriculum developers to establish cell phone use policies that are beneficial to students.

The use of cell phones in classroom may seem revolutionary in comparison to the traditional way of teaching and learning. And, as with every revolution, it is radically necessary for people to dialogue (Freire, 2014). Teachers and students must discuss their perspectives on mobile phone use in classrooms to examine the power dynamics of their views; where one can see mobile phones use as a form of liberation, the other may see it as class dominance (Preston et al, 2015). But through continual dialogue, mobile phone integration in classroom lessons can benefit both the teacher and the student.

Current research shows that the use of cell phones in education is driven by teachers to primarily stimulate motivation, strengthen engagement, and deliver content, not for constructive thinking or reflection (Sung et al., 2016). The use of cell phones in the classroom may enhance independent self-directed learning, inquiry learning and formative assessment. This is possible because of the technological features mobile devices now have such as "individualized interfaces, real-time access to information, context sensitivity, instant communication, and feedback" (Sung et al., 2016, p. 265).

Ideally, with innovative advancements, cell phone technology can become the premier educational tool that allows students to be more receptive and engaged in school activities anywhere, anytime. Cell phones can connect students with teachers in order to get their work completed and graded more efficiently. In his pedagogical framework of m-

learning, Park (2011) talked about the evolution to ubiquitous learning (u-learning). He referred to M. Weiser's (1991) definition that technologies that disappears in the background are the most profound technologies because it is embedded into individual's daily life. Park (2011) stated that within the education field, ubiquitous learning (u-learning) involves learning in an environment where all students have access to a variety of digital devices and services, including mobile devices and computers which are connected to the Internet, whenever and wherever they need them. And as mobile technology continues to provide more and more innovative applications for students in their social lives, students are finding ways to utilize their mobile phone for educational purposes despite policies that ban mobile phone use in schools. This is especially true for students who do not have access to other advanced technology such as web tablets and notebook computers (Thomas & Munoz, 2016). The use of technology will continue to be a part of our future, so it is imperative that digital literacy and various uses of technology be included in classroom curriculums by teachers (Preston et al., 2015).

Digital Divide and Digital Inequality

Studies on the digital divide in the past primarily focused on who had ready access to physical technology and the Internet and who did not (Warschauer et al., 2004; Cummins & Sayers, 1995). As schools continue to implement programs to provide expanded technology access for all students, schools failed to account for or even discuss the broader social contexts that proliferate the digital divide even further or in different ways. Although significant gains have been achieved in making computers and Internet access available to students both at home and in their schools over the last several decades, research is showing that inequalities persist with respect to technology use and student performance outcomes

(Scherer & Siddiq, 2019). The digital divide extends beyond whether students have access to certain types of technology; digital divide also includes which technology students prefer to use and how students are using their technology.

Digital Divide: Technology Access

In an earlier examination of the digital divide, Mark Warschauer (2003) points out various social aspects that reexamine the digital divide for Black and Brown students and categorizes technology access and use in three areas: performativity, workability, and complexity. Performativity relates to the notion that teachers oftentimes use technology in a way that only considers covering a basic skill or just going through an activity without homing in on constructing knowledge or providing meaningful relevant learning experiences for students (Warschauer et al., 2004; Lankshear & Knobel, 2003; Lankshear & Snyder, 2000). Earlier studies show that Black and Brown students, mostly classified with low-socioeconomic status, used computer technology for computer-based drills, visual presentations, remedial and vocational purposes whereas White and Asian students, mostly classified with high-socioeconomic status, used computer technology for simulation, data analysis and research (Becker, 2000; Wenglinsky, 1998; Warschauer, 2000; Warschauer et al., 2004).

Workability relates to the accessibility and reliability of technology at the time when computer and network connection is needed in both the classrooms and at homes for students. When new computer technology or applications are introduced for teaching and learning, administrator, teachers, and students depend and rely on the technology working without glitches or problems. Furthermore, when technology issues do occur, it is critical that

the technology or network connection be replaced, repaired, or remedied in a timely manner by someone with internet technology experience and know how (Warschauer et al., 2004).

Today, the cost of technology maintenance in the homes and at the schools is one of the key perpetrators of the digital divide (Rideout & Katz, 2016; Gonzales et al., 2020; Ems & Suri, 2016). Technology maintenance has three stages: achieving access, sustaining access, and coping with disconnection. (Gonzales et al., 2020; Shoemaker et al., 2004). Because it takes both financial and social resources to maintain quality access to digital technology, digital inequalities both originate from and contribute to socio-political inequalities (Gonzales et al., 2020; Gilbert, 2010; Ragnedda & Muschert, 2013; Robinson et al., 2015; Warschauer et al., 2014). Students with low-socioeconomic status often depend on "computing technologies that are broken, borrowed, or dependably unstable, cycling through routine disconnection" (Gonzales et al., 2020, p. 752).

Complexity relates to the challenge teachers have in integrating technology into their instructional strategies. One finding in the study shows that some teachers struggle with allotting time in class to implement new instruction activities using technology instead of preparing students for standardized testing. Another finding that adds to this complexity is that students have uneven access to computers and the Internet at home. And thirdly, the study found that teachers had difficulty teaching English Language Learners with computer technology within a lesson (Warschauer et al., 2004).

Lately, researchers have used the lens of technology maintenance to examine how inequities in the quality and stability of technology access impact people's lives and experience. Gonzales et al. (2020) notes how digital innovation instead of being used to achieve digital equality has only exacerbated social inequalities and has contributed to the

digital divide for students both at home and at school. Privileged students get to exploit and take advantage of digital technology for everyday and educational use while students with low-socioeconomic status continue to struggle to maintain whatever digital technology they have (van Deursen & Helsper, 2015; van Dijk, 2005; Robinson & Schulz, 2013; Robinson, 2014). Furthermore, studies show that there is a negative relationship between economic hardship and academic success; thus, high school students from low- to moderate-income families find it hard to keep up with other students (Robinson, 2014; Armstrong & Hamilton, 2013; Bozick, 2007; Goldrick-Rab, 2016; Paulsen & St John, 2002). In addition to the technology use and quality findings, those "families are often 'under-connected' due to intermittent disconnection, shared access, and slow or mobile-only in-home service" (Gonzales et al., 2020, p. 753).

Digital Divide: Social Aspect and Use

Ritzhoupt et al. (2013) have a similar view when bringing in the social aspect and use of technology to explain the digital divide in schools. The first level is the equitable access to hardware, software, Internet connection and technology support. The second level is how frequent and for what purpose students and teachers use technology in the classrooms. And third, whether students know how to use technology for their personal empowerment. Valadez and Duran (2007) also discuss what students do while using technology or when they are online in the context of race and socioeconomical differences. The digital divide can be defined by individual willingness to use technology for home, work, or school, as well as having the access to and knowing how to use technology.

The digital divide today is about more than having access to technology. The digital divide includes access to the social, human, and learning resources in which the adoption and

participation of technology provides capital access for socioeconomics and educational opportunities (Watkins et al., 2018). Because of the adoptions of mobile technology by Black and LatinX families, researchers have to study the participation gap, sometimes referred to as the digital literacy gap, instead of the access gap. This is the space where parents, educators, and policy makers need to provide opportunities and learning spaces for students to create social, civic, and economic futures through the use of technology (Watkins et al., 2018).

Watkins et al.'s (2018) book entitled "The Digital Edge: How Black and Latino Youth Navigate Digital Inequality" examines the social, educational and civic implications of technology being used by Black, LatinX, and immigrant youths within lower socioeconomic classes as related to digital inequality. The ethnographical research aimed to understand how digital media influenced the formal and informal learning environments of resource-constrained schools and families of teenage students. "The digital edge is the reference to the institutions, practices, and, social relations that make up the daily and mediated lives of Black, Latino, and lower-income youth" (Watkins et al., 2018, p2). The digital edge philosophy recognizes that Black, LatinX, and lower-income students' use of technology is influenced by a broader social context which promotes certain usage, techno-disposition, and opportunities to participate in the digital world. The digital edge is informed by three dimensions: the new geography of inequality, the persistence of the racial achievement gap in education, and the ever-evolving trends of media technologies adaptation.

The new geography of inequality explains that the neighborhoods that students live in shapes their access to life opportunities. A neighborhood that is rich in resources and high in social capital usually performs better in social mobility measures. Not only does this affect

student's overall performance in schools, but also their opportunities to effectively use technology, as well. In addition, what some researchers refer to as the second-generation segregation, White and Asian students are more likely to be enrolled in Advanced Placement (AP), International Bachelorette (IB), college prep, and gifted courses than Black and LatinX students. This is found in schools where the enrollment of Black and LatinX students is much higher than White and Asian students as well. Even in Career Technology Educational (CTE) classes with Black and LatinX students, there is more focus on foundational skills, such as learning a tool, instead of transformational skills, such cognitive and creative thinking (Tyner, 1998). The intersectionality of these dimensions highlights the complexity of mobile technology use for both social and educational purposes. Watkins et al. (2018) explains a mobile paradox: although Black, LatinX, and lower-income family lacked access to personal computer technology and reliable and consistence Internet connectivity at home, they were early adopters of mobile phone and smartphone technologies. This makes Black and LatinX students key contributors and drivers to the social media and digital world applications due to their use of smartphone technology. However, "very little is known about the creative and media production practices that are also a part of their social and media ecologies" (Watkins et al., 2018, p. 9). Black, LatinX and students in lower-economical families have access to technology mostly through their smartphones, oftentimes they lack access to instructional expertise and lesson activities or curriculums to develop their cognitive skills for today's knowledge-based economy. One highlight based on their findings is that smartphone technology use by students has addressed the nation's digital divide in was that policy makers, philanthropists, and educators have failed to do over the decades (Watkins et al., 2018).

Digital Inequalities in Schools

Digital divide is also characterized by the inequalities that students in low-socio-economic status experience in maintaining access to technology due to disruptions in health care, employment, and interpersonal social support (Gonzales et al, 2020; Gonzales, 2014, 2016; Gonzales et al., 2016). "The term ‘digital inequality’ was introduced to extend the digital divide concept to include access to different types of technology, as well as knowledge and skills in technology use, and the capacity of an individual to harness their skill" (Harris et al., 2017, p. 2).

Many of our public secondary schools encourage or require students to use digital resources to complete assignments, however the schools themselves are not able to assure equal access to technology or digital resources for all students. This is what Robinson et al. (2018) calls the digital bind because this affects students with low socioeconomic backgrounds more than other students, which is overlooked in the digital inequality discussion. Academic stratification has a significant effect on students' digital experience, as well. Students placed in advanced placement and college bound courses tend to have a better digital experience resulting in high academic performance. In a case study within a US high school, the findings show that the duration and usage intensity of digital resources for academic purposes at home or at school increases students' academic performance (Robinson et al., 2018). "Inequalities in access to digital technologies are also linked to inequalities in students’ experiences generally" (Gonzales et al., 2020, p. 753).

Watkins et al. (2018) points out that the schools that are usually located in higher socio-economic and influential neighborhoods are rich in human and social capital. As a result, they provide students with more advantages than schools that are struggling to

cultivate the assets of students in lower socioeconomics areas, usually which have a greater number of Black and LatinX students enrolled. Watkins et al. (2018) also believes that Black, LatinX, and lower-income students brings their own assets to their learning environment. Specifically, smartphones play a primary role as their technology asset.

In reference to Fordham and Ogbu (1986) and Carter (2005), Watkins et al. (2018) explains how most research suggests that Black students are not interested in achieving in school, however that is not the case. Instead, Black students have "opposition to authority and a disciplinary apparatus that subjects them to harsher punishment and cultural misunderstandings over their sartorial styles, language, and sources of cultural capital" (p. 12). Watkins et al. (2018) further points out that students participate in school by resisting and revising out of date and irrelevant district policies that restrict their ability to be more creative with technology. And, students are actions in school show that they are more interested in fostering opportunities and social relations to make school more interesting and relevant than building competitive profiles for college. This is not to say that some students are not interested in attending college, but rather find it more important to make school a relevant place to be while preparing for their post-secondary education opportunities.

Watkins et al.'s (2018) vision of learning is defined, studied, and explained by the Connected Learning framework. The Connected Learning framework states that learning is more powerful and more meaningful when it is linked across school, after school, at home and online. "Learning should be networked, experiential, production centered, and marked by a shared purpose between students and adults" (Walkins et al., 2018, p.13). This is a huge disconnect from what Black and LatinX students are experiencing in today's school settings.

While teachers may struggle to support students, who have less experience with digital literacy –that is, using basic features of technology and using computer applications to engage in cognitively demanding lessons– avoiding technology use in classes today only widens students' performance gaps (Braverman, 2016). While some may find it easier to work with students who can use technology very well because technology is readily available to them, these are students who Jones (2013) describe as having normalized class-privileged lives. Black and Brown students in lower socioeconomic situations is not fully experiencing digital technology in schools.

Rowsell et al., (2017) put it plainly when examining what is needed to confront the digital divide. We must first not give up on advocating for equitable distribution of digital resources in schools, which includes funding to support teachers in providing relevant and meaningful instruction in using technology and making sure there is consistent access to technology for all students. Secondly, we must fund out-of-school programs to support families in increasing their knowledge in using technology for educational purposes. Thirdly, we must ensure that we are using technology for critical and cognitively demanding activities in schools for student learning instead of just using the technology. And lastly, we must be diligent in sharing research and practices in collaboration with teachers and parents to provide robust digital teaching and learning for students (Rowsell et al., 2017).

As significant efforts have been made to address digital divide and digital inequities in schools, Scherer and Siddiq (2019) point out that inequalities persist with respect to technology use and student performance outcomes based on which technology students prefer to use and how students are using their technology. In my study, I focus on smartphone technology because students have readily access to a technology that is not

widely accepted in educational settings or for educational use. Furthermore, allowing and exploring the use of smartphone technology for educational purposes, addresses the various social aspects that Warschauer (2003) points out to reexamine the digital divide for Black and Brown students related to performativity, workability, and complexity. The use of smartphone technology can help close the divide.

Research on Mobile Phone Use in Urban High Schools

Mobile Phone Use Policies in Schools

Before mobile phone use in the classroom can become reality, it is imperative to first understand mobile phone policies throughout the nation. When examining the ten top school districts' cell phone use policies in the United States[2], the policies are written and defined with respect to students' behavior and discipline. More emphasis is placed on controlling when, how, and what content students are able to access while in schools, as well as how students interact and communicate with each other. The unfortunate result, I argue, is that educational policies surrounding cell phones are sometimes used to reinforce social inequalities and provide further harm, both physically and psychologically, to Black and Brown families. Thus, cell phone ban policies have created yet another way that administrators and teachers can punish and criminalize Black and Brown students in public schools. In other words, when school leaders and policy makers established that cell phones were devices that needed policing in school, then punishment for students who violates the

[2] I examined the cell phone use policies as written in the student code of conduct handbook and/or the technology use policies published by the top ten public school districts based on student population in the United States: New York City Department of Education, Los Angeles Unified School District, City of Chicago School District, Dade County School District, Clark County School District, Broward County School District, Hillsborough County School District, Houston Independent School District, Orange County School District, and Palm Beach County School District.

policy is also needed. So, with these ban policies, how often do students miss instruction time after being sent out of class or do parents receive calls for disciplinary hearings or do students get suspended just for using their cell phones in school?

Although cell phone use policies are ultimately defined by the principal of individual schools, two school districts are showing the most promising moves to lift cell phone ban use policies within schools. While for one district, the move is driven by the request of the community, in the other school district, district leaders see cell phones as a vital technology in meeting the diverse academic needs of students. New York City Department of Education (NYCDOE), the largest school district in the country, announced on January 7, 2015 a lift of the cell phone policy ban in schools due to increased political pressure from some in the community. One of the primary reasons for the shift states that "this change will better enable parents to stay in touch with their children, especially before and after school" (City of New York, 2015). The move to lift the cell phone ban policy is so that families and students can have a sense of comfort and safety by being able to stay in touch throughout the school day. On the other hand, the Broward County School District policy states that "The School Board of Broward County, Florida adheres to the belief that technology should play a vital role in meeting the needs of the broad range of abilities, disabilities, cultural backgrounds and ethnic populations represented in districts schools" (Broward County School District, 2019, p. 1). The policy further notes as a desired outcome that "technology will be appropriately equitably integrated into instruction and management processes and used by all students and staff as an integral component of school improvement and student success" (Broward County School District, 2019, p. 3). Unlike the cell phone ban or use policies of school districts and schools around the country, Broward County School District

does not have a stand-alone or separate cell phone policy or guidelines. The use of cell phone is defined within its overall technology usage, and it applies to both students and staff members.

In general, the other school districts' cell phone policies take a prohibitional approach or leave it up to the principals to develop a specific school-based policy. Almost all the policies give teachers or the schools permission the allow cell phone use in the classrooms for educational purposes but gives no guidance on how to do so. For example, Clark County School District has a Personal Technology and Communication Devices Policy P-5136, which states that students can use their cell phones during lunch, at school-sponsored activities and while on the bus; they may also use their cell phones during the instructional day, but only when permitted by the principal. Miami-Dade school district has a similar requirement when allowing its students to use cell phones for instructional purpose only; the district does not see the possession of cell phones as a violation of the Code of Conduct, but the use of them in the classroom or during the instructional day is banned unless the teachers instruct students to use them for educational purposes (Miami-Dade School District, 2019). Finally, Hillsborough County Public Schools District has the same restrictive cell phone policy within its Student Code of Conduct; their very brief code states that students are only allowed to use their cell phones during school hours and while on the bus "under the supervision of district staff for educational purposes only" (Hillsborough County Public Schools, 2019).

Other districts, such as the Los Angeles Unified School District (LAUSD) and the School Board of Palm Beach County, have even more restrictive cell phone use ban policies; they prohibit students from using their cell phones anytime during school hours. Although,

students can possess their phones, the phones must be turned off, and stored out of site in students' lockers, backpacks, purses, or pockets. However, students may use their cell phones before and after school unless requested not to do so by school personnel, or on the school bus in emergency situations (LAUSD, 2019; The School Board of Palm Beach County, 2019). Any incidents by students with cell phones that disrupts the orderly operation of the classroom, school, transportation, or extracurricular activities is considered a behavior violation of the policies. However, the districts give principals the authority to modify the instructional school day to allow students to use their phones while waiting for transportation or waiting for the start of school. The School Board of Palm Beach County takes its policy a bit further by providing a list of unauthorized uses of cell phones, as well as a list of some acceptable uses of cell phones within schools. Their policy states that cell phones can be used: for instructional or educational purposes in classrooms or during school activities if approved by the principal; for IEP, 504, or Health Care/Medical Plans with supportive documents from health care providers; for health, safety or emergency purposes; for school trips and sponsored activities at the discretion of the principal or designee; and for other reasons determined by the principal (The School Board of Palm Beach County, 2019). As with many other school districts' cell phone policies, the authorization falls solely on the principal to determine when, where and how students can use their cell phones.

Some districts, like Orange County Public Schools and Chicago Public School District, are taking small, incremental steps to incorporate cell phone use in their schools. Orange County Public Schools cell phone policies states that "students shall not be prohibited from using personally-owned devices for the purposes of supplementary learning" (Orange County Public School, 2019, p. 9). Although the Orange County Public Schools

District acknowledges potential educational benefits of using cell phones in school, their policy contains specific language about improper use of personal electronic devices. The policy states that students shall not use their cell phones "in any manner that poses a threat to academic integrity, disrupts the learning environment, or violates the privacy rights of others" (Orange County Public School, 2019, p. 9). To further clarify cell phone use, the policy states that wherever security cameras are not allowed, such as restrooms, locker rooms, changing rooms, and sleeping quarters, cell phones are not allowed. Similarly, the Chicago Public School District has begun to ease some of its cell phone restrictions. While its 2019-20 Student Rights and Responsibility Handbook states that students are not allowed to use their cell phones and other information technology devices at school, it does allow individual student cell phone use with written permission from parents. Chicago is the only school district that places the burden on the parents to request permission for their child to use their cell phone in school.

Finally, the Houston Independent School District cell phone use policy depicts how school boards and districts are wrestling with whether cell phones can be effectively used in schools. The result is a policy that is both ambiguous and inconsistent in how it defines proper cell phone use and penalizes improper use. The district considers the use of cell phones during school hours or on the school campus as a Level II act of misconduct. "Level II acts of misconduct include those student acts that interfere with the orderly educational process in the classroom or in the school" (The Houston Independent School District, 2019, p. 7). The policy states that the disciplinary actions taken by the principal or school administrative depends on the seriousness of the act and nature of the offense. However, within the same document, the policy states that cell phones "may be used at a time and place

as determined by the individual campus in coordination with the campus Shared Decision-Making Committee (SDMC)" (The Houston Independent School District, 2019, p. 7). Further, in the Code of Student Conduct manual, cell phones are mentioned as a potential media through which students can commit Level III acts of misconduct such as bullying or transmitting sexually explicit and racial activity. Thus, disparate treatment of cell phone use can be confusing to students.

In summary, the cell phone use policies from the top ten school districts in the United States are written and defined with respect to students' behavior and discipline. With minimal consideration for the educational benefits, cell phone ban policies are written to control when, how, and what content students can access while in schools, and to control how students interact and communicate with each other. School administrators and district leaders are concerned with what students are transmitting or accessing on their devices especially when students' cell phones relate to their own cellular provider. But since students can transmit information, communicate with others, or access information with their cell phones without the school's network, control and monitoring systems are established and standard policy language are currently written to be more restrictive or outright prohibited; they are generally written as precautionary measures. However, these restrictive and prohibitive policies, that are potentially widen the digital divide for Black and Brown students, are being modified in some districts in a move to accept students' personal mobile devices in school settings.

Effects of Mobile Phone Use in Schools

Studies show that teachers, school leaders, and students see great benefits in the potential of using mobile phones in classroom, but there are still some major concerns. In

one study, the benefits include reverse mentorship[3] and student motivation (Preston et al., 2015). Likewise, Thomas and Munoz (2016) identify several benefits such as: learning can take place anywhere, anytime; teachers can personalize instruction; and student can self-regulate their own learning. "Mobile phones have also been linked to applications such as assessment and research as well as administrative tasks and data collection" (Thomas & Munoz, 2016, p. 21). Alternately, some argue the perception of the challenges of cell phone use in the classroom might outweigh the benefits (Ariel & Elishar-Malka, 2019; Kwok et al., 2017; Preston et al., 2015).

A key component that is missing in earlier studies about cell phone use in schools is the voice of the students. However, more research is now emerging that involves students' voices in the discussion. In their study on urban high school students in the Midwest region of the United States, Thomas and Munoz (2016) find that 90.7% of the students reported using their cell phones for school-related work such as using the calculator, accessing the internet, checking their calendar and the time, using educational apps, playing music, sending/receiving texts, watching videos, downloading apps, and sending/receiving emails. In the same study, with a high level of agreement based on surveys conducted, the students support the use of mobile phones in the classroom and believe that mobile phones support student learning.

[3] The concept of reverse mentorship or reciprocal mentorship refers to a learning-related situation where a younger individual (a student who knows more about technology) teaches, mentors, and/or offers advice to a more experienced individual (a teacher who may know little about the technology); a process which can benefit both parties (Gabriel and Kaufield 2008).

In AlTameemy ‘s (2016) study which investigates the academic use of mobile phones by recent high school graduates and their teachers as well as their attitudes in using mobile phone as a learning tool, the study finds that over 95% of the participants use various type of applications on their mobile phones for teaching and learning. The study further shows that participants agree with the statements that mobile phone contributes to their self-learning and that mobile phones will increase their knowledge, measuring an average of 3.84 and 3.78, respectively on a 5-point Likert scale where 5 is Strongly Agree. The top two applications used are dictionary and Internet search at 68.5% and 66.4% of the participants, respectively. Similar results are found in Ott et al.’s (2017) study that examines students’ voices on mobile phone use in Swedish upper secondary schools. According to the survey administered to 206 students with validated themes from four different focus group interviews with a total of 19 participants, the top four daily uses of mobile phones by students as a technology device for learning were: cooperation with classmates by social media, translation of words, editing picture and sound, and connecting the computer to the Internet.

Ott et al. (2017) researches the perspectives students have concerning the use of mobile phones in education from the view of infrastructure as a layered and relational ecology of tools and action within the educational setting. The paper notes that infrastructure can be viewed in two parts. First, there is a universal service infrastructure, which is an infrastructure that is open to everyone. Second, there are work-oriented infrastructures which are open only to participants in specific practices or workplace (Ott et al., 2017). Thus, any resources or arrangements (such as social, institutional, or technological) that are available within or are brought into the educational setting are considered to be a part of work-oriented infrastructure (Ott et al., 2017). “When students bring their mobile phones to

school, they are bringing a technology into school without any formal affiliation to school's infrastructure for learning" (Ott et al., 2017, p. 518). However, since the mobile technology is still being used or has the potential to be used for educational purposes, the students' personal mobile phone devices are a part of the school's work-oriented infrastructure.

Recognizing that there are inequities regarding the use of and having access to technology whether at school or at home for Black, Latinx, and Immigrant students as well as students with low socioeconomic status, Watkins' et al. (2018) book provides an ethnographic study to examine the social, educational, and civic implications of what is referred to as the digital divide. In reviewing Watkins et al.'s book, Paul (2019) points out from the study that even with this digital divide and outdated technology within low-quality schools, traditionally marginalized students "have developed innovative strategies to bridge the technology gap" (p.737). In another view, AlTemeemy (2017) notes three aspects to the digital divide. One, there is a digital divide between the new educators and the older school of educators; newer and younger school of teachers do not tend to see mobile phones just as distractions in schools but rather as a useful educational tool. Two, the digital divide is when some students have access to technology and know how to use it versus other students who do not. In other words, there are opportunities to promote learning using technology, but some students are not able to contribute or make meaning of some of the lessons content due to lack of Internet connectivity or access to certain type of technology. The third and final aspect of the digital divide occurs when the learning and productivity of using technology greatly differs based on who has and who does not have resources, whether financial or technological.

Based on data that was collected over a one-year period from observations and in-depth interviews of student, faculty, and administrators at a majority-minority high school located near Austin, Texas, the book further discusses how students' expectations and use of technology clash with restricted school curriculums, and how schools block Internet sites such as YouTube and Facebook that can potentially be used as educational material (Paul, 2019). This aligns with AlTameemy 's (2016) findings that about 20% of participants rank using YouTube videos and Facebook as top mobile applications for educational purposes. The book goes on to explain that even though Black, Latinx, and Immigrant students usually find a way to use whatever technology they have access to in order to get connected, oftentimes they lack the "access to social and cultural capital that can help them participate more meaningfully in online communities" (Paul, 2019, p. 738). Which means that traditionally marginalized students are usually left out of Science, Technology, Engineering, and Mathematics (STEM) related job opportunities, technologically innovative design processes, and digital literacy educational opportunities.

An increasing number of empirical studies are being developed to find effective ways of using mobile phone technology for educational purposes. AlTameemy (2016) identifies three reasons why this is important. First, it brings meaningful context to the curriculums of today's students. Secondly, teachers and students can provide fun and tangible ways to use the vast number of applications for learning in the classroom. And third, classes can become more student-centered; students will not have to depend on just the teacher for the source of knowledge, which is usually one-sided, but they can autonomously learn from other sources as well. Hence, there is a strong need to bring together all the stakeholders -students, teachers, school administrators, parents, and education policymakers- to actively engage in

dialogue on how to effectively integrate the mobile phone technology within an educational setting (Ott et al., 2017; Humble-Thaden, 2012). Unfortunately, many school districts currently have mobile phone use policies that are ambiguous on when, where, and how mobile phones can be used in schools.

In a paper titled, "The Proliferation of Cell Phones in High Schools", Maphalala and Nzama (2014) identify other concerns with cell phone use in school from teachers, parents, and students which their concerns are reflective of the reasoning behind the ban cell phone use policies. Their concerns include the inherent belief that students are addicted to social networks and will spend more time on them at the expense of their studies, resulting in high failure rate in classes. Additionally, they believe students will distribute inappropriate material like pornography to each other and engage in cyberbullying (Maphalala & Nzama, 2014).

To further show how there are mixed positions in using cell phones for educational purposes, a neuroscience researcher, Manfred Spitzer (2015), cites in a study related to mobile learning (m-learning), the many risks and side effects of cell phone use. Spitzer (2015) claims that cell phones cause addiction, attention deficits, impaired learning, depression, and personality disorder, just to name a few. The study further states that "outsourcing mental activity leads to reduced learning" when students use cell phone in their classes (Spitzer, 2015, p. 87).

Negative Effects of Mobile Phone Use in Schools

Preston et al. (2015) shows that the negative effects of cell phones in classroom include "inappropriate texting, policy and lack of policy related to technology, the erosion of traditional literary skills, and an increased workload for teachers" (p. 177). There are still

lingering fears that classroom disruptions and behavior issues such as cheating, sexting, and cyberbullying could become major issues in schools with increased cell phone use (Thomas & Munoz, 2016). Also, Thomas and Munoz's (2016) study find that 54% of the students surveyed indicate that the ringing of cell phones is a barrier to using them in classrooms. Additionally, 40% believe it enables cheating, 39.3% believe it disrupts the class, 36.5% believe it promotes cyberbullying, 34.2% believe it allows access to inappropriate content, 27.9% believe it facilitates sexting, and 23.4% believe it has a negative impact on writing.

The school districts' cell phone ban policies discussed are developed based on the belief by policy makers and school administrators' that cell phones are a distraction to students' academic performance and the fears of mischievous behavior that may be caused by students (Thomas & Munoz, 2016). Most research studies related to cell phones in school aligns with this position, however there are a growing number of research studies that challenge it. For example, in their meta-analysis of the effects of mobile phone use on academic performance over a 10-year period from 2008 to 2017, Kates et al. (2018) find that thirty-six of the thirty-nine studies on average found a negative effect of -0.16 with a 95% confidence interval of -0.20 to -0.13 (z-value of -9.14, $p < .001$), while the other three studies showed a positive effect on students' academic performance. In another meta-analysis study that looked at the effects of integrated mobile devices in teaching and learning from 1993 to 2013, Sung et al. (2016) find that the overall mean effect size for learning achievement is 0.523, which means that "learning with mobiles is significantly more effective than traditional teaching methods that only use pen-and-paper or desktop computers" (p. 257). Specifically, the study shows that students in high schools had medium effect size ($g=0.451$, $z=4.274$, $p<.001$) when looking at learning stages, and handheld devices like cell phones had

a medium effect size as well ($g=0.591$, $z=10.992$, $p<.001$) when looking at the different technology hardware that is being used.

There are limited empirical studies that primarily look at cell phone usage effects on high school students' performances, so it is worth considering empirical studies from the collegiate level as well. According to data collected from eight introductory science courses over two semesters at a large state university in the western U.S., a negative correlation between in-class phone use and final grades was found. For students who used cell phones in class, their final grades were 0.38 ± 0.08 (on a 4-point scale) lower than students who did not use cell phones in class (Duncan et al., 2012). In the same study, 32% of the students surveyed found cell phone use by other students distracting. In another study designed to simulate a classroom with student texting, the study showed a 27% decrease in quiz performance for the texting classroom when compared to the non-texting classroom (Froese et. al, 2012).

In a study conducted to examine the effects of in-class cell phone texting on final grades in a freshmen level introductory social science course at a small college in the Midwest, the results concluded that the greater in-class texting behavior was associated with lower final grade scores (McDonald, 2013). In this study, different sections of the same course used different cell phone policies. In one course section where students were reminded about cell phone etiquettes and respecting other students in class, students average final grade score was 81%. The second course section where students had the strictest cell phone policy, the student average final grade was 77%. The third course sections that had the highest in-class texting behavior and no policy, the average score was 73% (McDonald, 2013). In a similar study, Ellis et al. (2010) conducted an experiment that showed one half of

a class of 62 students that were allowed to text scored significantly lower on a quiz than the other half of the students who were not allowed to text.

Wentworth and Middleton's (2014) study partially supported their hypothesis that there is a strong negative relationship with frequent and continuous use of technology and academic performance. The study showed that a small, significant but negative correlation exists between students' computer use and their GPAs; a stronger negative correlation exists between students' computer use and the amount of time spent studying. Furthermore, the study showed that "the number of texts per week and a student's SAT quantitative score accounted for 16% of the variance in their predicted course grade" (Wentworth & Middleton, 2014). However, the study showed that frequency of cell phone use did not appear to be significant predictors of course grade.

Ironically, it is worth mentioning that, while most of the research today focuses on how smart technology devices are nothing more than a performance distraction in classrooms, past studies conducted to determine what distractions students faced when they were using computer assisted instruction. Sigmund Tobias (1973) found in his study that "distraction affects achievement when the distracting stimuli are less boring, more entertaining, or more motivating than the instructional material" (p. 236). Tobias (1973) suggested that distractions were problems for students, not because they were incapable of multitasking, but rather because they would pay more attention to the activities that they found more motivating during a lesson. Which leads back to the point that I argue, is that because smartphones are an intimate part of students' lives that has fueled the mobile youth culture, an examination of the opportunities that includes the voices of the students to purposely embed smartphone technology use within the education process and learning

experiences is needed. Hopefully, the results can drive a change in school's mobile phone use policies, increase students' engagement, motivation, and academic performance, and minimize the digital divide and technology inequalities for Black and Brown students.

Benefit & Challenges of Effective Use of Mobile Phone Use in Schools

In Maphalala and Nzama's (2014) study, which identified concerns with cell phone use in school from teachers, parents and students, the researchers found that 76% of the learners surveyed believed that cell phones could be used in high school as an educational learning tool, concluding that the benefits of the students' cell phone use outweigh the disadvantages. Similarly, Thomas and Munoz (2016) found that about 74% of students supported integrating mobile phones into the classroom and 71% of students believed that mobile phones supported learning. Additional survey results show that students identified the top five perceived benefits of using cell phones in the classroom as reducing the digital gap, providing learning opportunities, increasing digital fluency, encouraging creativity, and providing differentiation of instruction: with each of these benefits receiving responses of over 80% (Thomas & Munoz, 2016). According to the Pew Research Center, 73% of Advanced Placement and National Writing Project teachers used cell phones for educational purposes in the classroom and for assignments (Cho et at., 2018).

In a study driven by the desire to eradicate low performance in mathematics for high school students in the Caribbean by Kalloo and Mohan (2011), the results show an increase in average performances in two separate groups of students who used applications on their mobile phones to supplement the lessons in their math classes. The mean value of the pre-test of Group 1 increased to 63.5 from 55.1 (a two-tailed significance t-test =0.025, which is less than 0.05). This implies that there is a significant difference between the pre-test scores

and the post-test scores. The mean value of the pre-test of Group 2 was 30.7, while the mean of the post-test was 40.85, showing an average increase in performance (a two-tailed significance t-test=0.001 which is less than 0.05). This implies that there is a significant difference between the pre-test scores and the post-test scores for Group 2 (Kalloo & Mohan, 2011). What makes this study different from the others is that there was a defined use and purpose for the cell phone in the class.

For example, in a pilot program using cell phones in a pre-calculus class at a high school in West Nyack, NY around the same timeframe, Engel and Green (2011) observed gains in students' participation, reflection, assessment performance. The educational use of the cell phone in the pre-calculus class was not left up to chance but was clearly defined and planned within the lesson activities. The cell phone was used as a device to capture the responses of students, as a research tool, and as a tool for collecting evidence of student work (Engel & Green, 2011). As a result, teachers were able to check for understanding in real-time and adjust the lesson based on students' feedback from the applications used with the cell phone. In addition, teachers were able to utilize backchannel communication features of online applications used on the cell phone to gain insight on what students were thinking at particular moments in the lesson.

In a meta-analysis based on 20 studies between 2005 and 2017 to measure the effects of using mobile devices on student achievement in language acquisition and learning, the researchers found a moderate positive overall effect of 0.51 with a standard error of 0.10 (Cho et al., 2018). In another meta-analytic study involving 14 peer-reviewed research articles published between 2010 and 2014 examining the effects of mobile devices on grades K-12 student achievement in science, mathematics and reading, Tingir et al. (2017) found

that the use of mobile devices in teaching yielded higher achievement scores in all subject areas than traditional teaching with average effect size of 0.483 with a standard error of 0.113; across all mobile devices. When examining specific device type categories, smartphones mean effect size was 0.452 with a standard error of 0.136.

Although the focus for my research is for high schools, there are more research studies of mobile phone use published related to higher education classrooms (Pedro et al., 2018). I find the results of some studies specifically looking at smartphone devices applicable for high school settings. For example, in their study with surveys and focus groups interviews with students in higher education institutions, Anshari et al. (2017) found that smartphones are useful learning aids. First, smartphones are convenient and portable. Secondly, smartphones have the technological abilities to offer comprehensive learning experiences. Thirdly, smartphones provide access to multiple sources and facilitate opportunities for multitasking with the lesson activity. And finally, smartphones are actually environmentally friendly in educational settings. However, while smartphones are easy to use, convenient, effective, and fast, the study also shows that smartphones can also be distracting, they may foment addictive behaviors. They can limit interpersonal skill development, and they may reduce the quality of content deliverables and peer-to-peer/peer-teacher interactions (Anshari et al., 2017). These same benefits and challenges from smartphone use in higher education are applicable in today's high schools, as well.

In today's K-12 classrooms, teachers and students can rely on smartphone technology because the device is present in our daily lives, smartphones are hand-held computers with integrated technology features like multimedia recording, web browsers, and personal computing, and a growing number of mobile applications are being developed for

educational activities (Cho et al., 2018). Additional empirical and qualitative studies specifically designed around using smartphone technology in high school curriculums are needed to further examine ways on how the youth mobile culture can influence in the educational system.

Curriculum Planning and Mobile Phone Technology

While limited studies show that mobile phones can enhance students' learning experience and academic performance, the actual impact can only be determined when there is a closer integration of the curriculum and mobile phone technology (Sung et al., 2016). Robinson et al. (2010) suggest four areas to help mitigate the inappropriate use of technology in classroom settings: awareness and knowledge, policies, student education and understanding, and parent involvement. Teachers and school administrators should have a clear understanding of the technology being used and its potential safety and security issues for the school community. There should be clear policies in place that states when, where, and how the technology can be used in the classroom. Students should have a thorough understanding of what is expected of them when using their personal devices and have knowledge of the safety and security issues as well. And parents should be kept aware of how and why cell phones are being used within the classroom.

Mobile Technology Use as an Intimate Part of Teen Culture

The mobile phone adaption by young people over the last two decades is now a part of their lifestyle and culture. Observing that young people use their mobile phones in certain ways to support and enhance their life as well as to form identities, gain autonomy, and manage relationships, scholars have referred to this as mobile youth culture (Castells et al., 2007; Campbell & Park, 2008; Axelsson, 2010; Ling & Bertel, 2013; Ito, 2005; Ling & Yttri,

2006; Ling, 2004; Caronia & Caron, 2004). Earlier perspectives of mobile youth cultures recognized that the technological features of mobile phones both enabled and constrained human behavior -a view known as apparatgeist (Vanden-Abeele, 2014; Ling & Bertel, 2013; Castells et al., 2007; Haddon, 2007; Katz & Aakhus, 2002). This is not to say that all young people use their mobile phone the same way but rather the limitations of the technology define its use. However, Vanden-Abeele (2014) points out that the emphasis of this 'youth monoculture' in earlier studies failed to take into account the variation of mobile lifestyles, and the observation occurred was well before the development and widespread use of smartphones by teenagers. The heterogeneity in youth mobile phone use, at both the group level (institutional, demographic, and cultural variations) and individual level (social-psychological variations), is determined by the social, cultural, structural, social-psychological needs of the youth (Vanden-Abeele, 2014). For some youth, mobile phone meaning and use is like entering high school or getting their driver's permit. For others it will depend on their socio-economic backgrounds, popularity status, and social self-concepts (Vanden-Abeele et al., 2014; Vanden-Abeele & Roe, 2013; Blair & Fletcher, 2011; Jackson et al., 2009; Castells et al., 2007; Ling, 2004; Wilska, 2003).

In the youth mobile lifestyle study by Vanden-Abeele (2014), the top eight gratifications from mobile phone use by youth were: 1) micro-coordination, mobility, and immediacy, 2) ability to keep up with friends and family, 3) safety, 4) ability to discuss and arrange schoolwork, 5) ability to express love to someone, 6) to pass time, 7) to avoid face-to-face interaction, and 8) to be fashionable or express status/identity. With respect to the social-psychological, the study found that the mature youth seek more pragmatic gratifications from their mobile phone whereas the younger youth, who struggled with their

emotions and were more concerned with how they fit in with their peers, depend on their mobile phone features the most. Vanden-Abeele (2014) concludes that mobile youth culture is not just the youth's "psychological development (i.e., the functional view), but also a reflection and/or reaction to the structural position assigned to them by the schooling system and, by extension, society (i.e., the structural view)" (p. 922).

With the rise of smartphones, Yan (2018) sees the effect of mobile phone use as an unparalleled complex developmental phenomenon. A phenomenon that has multifaceted (involving the technologies, users, activities, and effects), multilayered (having a general mobile culture and a youth mobile culture), and multi-processed (having mediation and moderation) processes with both benefits and challenges. Smartphones have transformed from the two original basic features of being mobile and a communication device to one that has personalized, and multifunction features which can be directly and/or indirectly related to adolescents' development (Yan, 2018; Bronfenbrenner & Morris, 1998; Bruner, 1996; Vygotsky, 1978). Children are growing up in constant communication and connections with their peers, creating new standards of behavior and communication through mobile technologies, hence the youth mobile culture (Yan, 2018; Lauricella et al., 2014; Rogoff, 2003; Vygotsky, 1978).

In particular, digital natives (DN), who have grown up with digital technologies, may have different understandings of excessive IT use from digital immigrants (DI), who were first exposed to digital technologies later in life (Anh & Jung, 2016; Prensky, 2001). Smartphones are no longer a technology that is functionally devoted to communication; they allow users to have a wider range of activities, such as Internet surfing,

sending email, playing social games, and social networking (Anh & Jung, 2016; Billieux, 2012)

Now that computing technology, networking capabilities, and real-time person-to-person connectivity is possible through smaller, less expensive devices like smart phones, why are schools spending instructional time enforcing cell phones bans instead of embracing the technology inside the classrooms? Could it be because initial research studies only focused on how cell phones lowered students' academic performances, as well as to what extent cell phones distract students during the school day, instead to considering their academic benefits? Educators and curriculum providers have an opportunity to explore and create ways to embed cell phone usage and applications within instructions for high school classrooms.

When schools ban cell phones, which play an integral role in student lives, they forgo the benefits of connecting students with the learning process and reduce the potential for students to collaborate with each other and with teachers. I argue that school districts should revise their ban policies on cell phones to encourage students and teachers to utilize readily available personal technology within the learning process. Furthermore, I argue that educators, curriculum developers, students, and technology application designers can embed cell phone technology use into secondary education by creating pedagogical roles for mobile devices in such a way that it provides engaging and relevant activities that will better connect students to lesson concepts.

In their research to examine the dependence on smartphones by the younger generation, Anh and Jung (2016) conclude that portability is the central element on why mobile phones have become a part of youth daily lives and have transformed culture and

values. The portability property of smartphones provides a ubiquitous availability of the Internet and various online applications as well as a better way to communicate and pass time. Also, the portability factor may result in the perception that young people unnecessarily use the device all the time or that here has been a decrease in social and family interactions by youth (Anh & Jung, 2016). The study uses social representation theory and attribution theory to explain their findings when comparing the digital natives and digital immigrants' perceptions on the smartphone addiction phenomenon.

From the social representation theoretical view, the degree of familiarity with smartphone technologies may have an influence on individuals' perception of and attitude toward digital technologies use based on which generation you are in. And this gap between generations may cause distorted social communication, which ultimately induces social conflicts. The younger generation -who are the digital natives- see smartphones as the primary means of communication and as a convenience while the older generation -who are the digital immigrants- sees smartphone technology as a social problem for youth (Anh & Jung, 2016; Nam, 2013; Prensky, 2001; Moscovici, 1961, 1984). From the attribution theoretical view, the younger generation -the highly involved actors- believe their dependance on smartphone is attributable to the portability of the technology and their social situation while the older generation -the rarely involved observers- attributes the use to personal disposition (Anh & Jung, 2016; Fiske & Taylor, 1991).

Being connected online to social media offers urban youth in disadvantaged neighborhoods a digitally safe community space, like coffee shops or community centers; such places are called the digital third space (Stevens et al., 2017; Oldenburg, 1989). Digital third spaces provide a sense of refuge for both social and personal good for youth living in

disadvantaged neighborhoods stricken with poverty, drugs, and violence (Soukup, 2006; Holt et al., 2009; Jarrett, 2003; Wacquant, 2010). However, there is youth drama and social ills such as bullying even within the online community because social media is a part of the intersectionality of youth's identities and culture (Stevens et al., 2017). What happens in the physical neighborhood may bleed over into the online social media spaces.

Impact of Criminalization of Mobile Phone Use in Schools

As a teacher, content team leader, instructional coach, and administrator over that last eleven years at an urban high school, I witnessed students getting in trouble for just taking their phones out of their pockets, bookbags, and purses. Some of the students were just looking at the time or checking their grades on the student information system. For a very brief moment, I was one of those adult perpetrator asking students to put away their mobile phones. But being a person with a technical and education background, I asked myself, why am I asking students to put away and not use their personal technical devices that I believe could enhance their educational experiences and why would I want to support a system that I argue is criminalizing students' use of their own personal devices. And, after a preliminary literature search using several online search tools, to my surprise I did not uncover any research that examined the criminalization of mobile phone use in schools per se. However, what was uncovered was the examination of the on-going tension between students and teachers/administrators around the enforcement and ignorance of cell phone use policies in schools.

For example, in one study exploring school regulations of students' technology use, the researchers discussed "the recurring tension between private ownership and school standardization of students' technology" (Selwyn & Bulfin, 2016, p. 286). Some students

and teachers struggled with how the school system was dictating how and when to use their own personal devices even during non-academic times within the school day or when lessons were too boring (Selwyn & Bulfin, 2016). In an earlier study, the researcher found that high school students often break, ignore, or negotiate with their teachers concerning the mobile phone use policies within their schools because of the inconsistency of enforcement, the ambiguity of understanding the rules and social habits of using the mobile phones (Charles, 2012). Based on the study, Charles (2012) concluded that while both teachers and students acknowledged the potential dangers of mobile phone use in schools such as bullying, sexting, and cheating, they also recognized that there needed to be a reasonable and balanced set of rules concerning mobile phone use in schools.

With about 60% of students responding that some digital technology use school rules should be changed, students deal with technology and mobile phone use policies in schools by "working around" the rules (Selwyn & Bulfin, 2016). One work around is by exploiting the teachers' inconsistency and non-enforcement of the rules. Charles (2012) finds that cells phone policy enforcement by teachers ranged from “strictly authoritative, through reasonably restrictive, through laissez-faire, to oblivious" (p. 10). Another work around is using technological hacks like establishing VPN (virtual private networks), using web proxies, or using teacher/admin passwords to access internet sites blocked by the school. And lastly, students just hide their personal devices while using them (Selwyn & Bulfin, 2016).

The students’ challenges to the school technology use policies in the study were seen mostly as working arounds the rules rather than “working against” the authority (Selwyn & Bulfin, 2016). There were several responses that can be considered as acts of resistance or directly challenging the power dynamics of the school, and a few responses that were seen as

fighting back against dominance relations and power in the school (Selwyn & Bulfin, 2016; Aggleton & Whitty, 1985; Högberg, 2011; Raby, 2005; Jonsson, 2014). This further implies that student-teacher relationships based on trust and respect moves from an authoritative teaching role to one that works with students to gain understanding on how to effectively use mobile phone in schools to incorporating mobile phone use in pedagogical practices, to continued discourse on youth mobile phone use (Charles, 2012).

Summary

Smartphone technology can be that educational tool where students can be more efficient and engaged in school activities anywhere, anytime. Taking this technological journey with students will require an open mind and a willingness to set aside the traditional education settings that were established during the industrial age. And because smartphone technology use ban in schools is an established policy in many school districts, discussions are needed between education policy makers, district leaders, teachers, students, school leaders, app designers, and curriculum developers to establish smartphone use policies that are beneficial to students. By first acknowledging that smartphones are an intimate part of students' lives, smartphones can become an important tool during the time students are in school as well as out of school. Others may lean on early research studies that shows low student performance because of cell phone distraction, however to date, no concerted effort has been made to develop educational activities and curriculum around smartphone technology. Further research is needed to see how smartphone technology use in classroom can be as beneficial to the educational process just as it is for students' social lives. And for small number of students who do not have smartphone, school issued web tablets or notebook computers can be available.

CHAPTER 3

METHODOLOGY

"I am no longer accepting the things I cannot change. I am changing the things I cannot accept." -Angela Davis

Introduction

In Chapter One, I discussed the purpose and rationale of this study, and why this question is important for us to examine due to the digital youth culture we are experiencing today. With over 95% of American teens have access to a smartphone and are constantly on them every day (Anderson & Jiang, 2018), it is imperative that we examine whether a paradigm shift is needed on what schools consider to be acceptable technology for educational purposes. In Chapter Two, I discussed the tenets of the culturally relevant pedagogy and culturally responsive teaching and how both theoretical frameworks set the foundation for culturally responsive computing tenets. I showed how smartphone technology use in schools has become prominent topic for educators, school leaders, and district policy makers by first examining the evolution of technology implementation in K-12 schools in the United States, secondly by examining the digital divide and digital inequalities that are persistent in the education system, and lastly by examining the effects of mobile phone use policies in urban high schools. In this chapter, I discuss the quantitative methodology that was used in this study and my rationale to begin this research journey with this approach. I explain the reason for the potential participants and how I ensured the validity and reliability

of the data collected. Furthermore, I outlined my procedure to data collection and data analysis of this study.

Research Design

For my study, I used a quantitative research methodology approach to explore and uncover the connection on students and smartphone technology use for learning experiences both inside and outside the classroom. With this approach, I collected the quantitative data from the participants that was used to provide quantitative descriptive information to examine the behavior, attitudes, and beliefs on how students used their smartphones for education and compared the role of compounding factors of students' grade level, race, and disabilities in the analysis (Creswell & Creswell, 2020; Hoy & Adams, 2016). In addition, the participants open-response statements were coded and quantified. The general collection of demographic information simultaneously provided me with an opportunity to gather quantitative data that can be used to identify the beliefs and perceptions of the participants (Creswell, 2015). The participant's data was collected using a quantitative online web survey designed for smartphones. Although I used a single-mode survey instrument, I used multiple mode of communication with the participants to maximize coverage and to minimize the nonresponse rate.

Rationale for Quantitative Design

Although mobile phone technology is being used for learning around the world outside of traditional classrooms, there is increased use of mobile phone technology in schools today (Park, 2011; Maphalala, 2014; Sharple & Vavoula, 2007). However, there are empirical research gaps is examining the pedagogical considerations for smartphone use in secondary education. First, there are limited studies examining the instructional usefulness

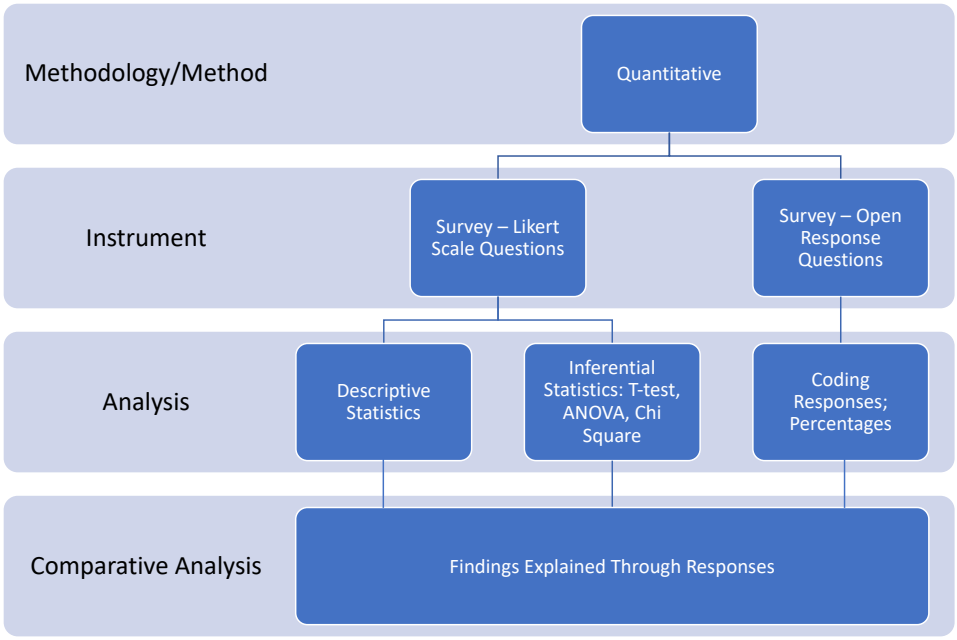
of mobile phone technology in high schools. Secondly, the attitudes and perceptions of mobile phone use in school or for educational purposes studies mostly involved adult participants such as college students, teachers and school leaders; very few considers the perspective of high school students (Thomas and Munoz, 2016; AlTameemy, 2016; Ott et al., 2017; Paul, 2019). Thirdly, because the technology advancement of smartphones is constantly evolving, the earlier studies examining the use of mobile phones in schools lacked the consideration of a wide range of computer applications and global connectivity (Sung et al., 2016). As a result, existing studies mostly highlights smartphone use in schools as a distraction. And lastly, today's high school students are a part of the digital youth generation where smartphones have become essential in their lives (Yan, 2018; Vanden-Abeele, 2014). These factors have led me to further examine the usefulness of smartphone technology in high schools based on students' perceptions and attitudes. A quantitative study can provide information to help shape the discussion on whether students feel that mobile phones are a distraction or whether mobile phones are useful in school. In addition, the quantitative results can provide the foundation for further qualitative inquiry to strengthen the study. It is my hope to uncover evidence that will transform the negative perceptions of the use of smartphone technology in educational settings and to learned how students can help shape districts and schools' policies on smartphone use.

Quantitative Design

The research design for this study consisted of quantitative methodology using a web-based Likert scaled and open-response question survey. Figure 3.1 describes the research methodology used for this study as well as the analysis.

Figure 3-1

Research Methodology



Researchers using quantitative design methodology are interested in examining the relationships between and among variables (Creswell & Creswell, 2020). Whether it is evaluating the association between the variable —this is a correlational hypothesis— or testing whether one variable cause another —this is a causal hypothesis—, quantitative research carefully examines a purposeful set of variables to answer a hypothesis or a theory-guided research question (Creswell & Creswell, 2020). Researchers typically use an experimental design approach for causal hypothesis type studies and a survey instrument design approach for correlational type studies (Creswell & Creswell, 2020).

"An experimental design systemically manipulates one or more variables in order to evaluate how this manipulation impacts an outcome (or outcomes) of interest" (Creswell & Creswell, 2020, p. 207). The study involves one group receiving a treatment, the treatment

group, while to other group does not receive the treatment, the control group. An evaluation is made on whether the treatment had an effect on the outcome (Creswell & Creswell, 2020). "A survey design provides a quantitative description of trends, attitudes, and opinions of a population, or tests for associations among variables of a population, by studying a sample of that population" (Creswell & Creswell, 2020, p. 207). There are three types of questions within a survey design: descriptive questions, questions about the relationship between variables, and questions about predictive relationships between variable over time (Creswell & Creswell, 2020).

For this study, I used a quantitative design methodology to examine the perceptions and attitudes of high school students by different grade levels, race/ethnicity, and disabilities. The quantitative method began with descriptive and inferential statistics to compare the means of survey questions and to determine if there are significant differences in the means amongst the different student groups. The open-response question responses where coded and quantified to further examine the trends of the participants' attitude about smartphone use in school. This empirical study further fills the gap within the current body of research related to mobile phone technology use in education that lacks the participation of high school students.

The quantitative survey design for this study allowed me to gather data from high school students that uncovered on how smartphone technology is being used for educational purposes. I used an online survey instrument to obtain quantitative description of high school student attitudes and use of smartphone technology for educational purposes whether in-school or outside of school. I used a self-administered online survey where participants used either a URL link or QR Code to access and to complete the online survey using their

smartphone, Chromebook, or any computing device. Participants were invited to complete the survey via their school-based email, flyers posted in the school and personal announcement in their math class.

Selected Sites and Participants

My study took place in two Boston Public Schools open enrollment high schools with a large population of Black and Brown students. More specifically, I selected two high schools that have a Black and Brown combined student population that also makes up the majority of the school's enrollment. Black and Brown students within low socio-economic family status who are more likely to own and use smartphones as the only computing technology. Participants were high school students in the ninth, tenth, eleventh and twelfth grades. The two high schools selected were open enrollment schools. Both schools had a higher number of students in the district who were classified as High Needs and Economically Disadvantaged by the state.

According to the Massachusetts Department of Elementary and Secondary Education school profile online report, the Boston Public Schools' 2021-22 school year total number of 9th grade, 10th grade, 11th grade, and 12th grade students were 3513, 3362, 3565, and 3581 respectively. The district reported about 72% of the total enrollment as Black and Brown students; students who classified themselves as Black/African American or Hispanic. I collected 202 total survey responses. Participants in the analysis included for each grade-level were 41 from 9th grade, 72 from 10th grade, 24 from 11th grade and 37 from 12th grade across both schools.

A letter of participation was obtained by the Head of School at each school and approval of the study was granted by the Boston Public School IRB office. The research was

conducted as an online survey via the Qualtrics platform within the University of Massachusetts-Boston information technology services system which took into account mobile devices online survey optimal features. Students' school-based emails were obtained by the registrar's office at each school. No known local requirements, regulations, or customs affected this research.

Procedures and Instruments

The invitation to participate in the study was sent to 9th through 12th grade students at both schools via their school-based emails, as well as on flyers that will be posted by me around the school one month prior to the survey release. The emails and flyers were written in English, Spanish, and Portuguese. The email invitations and flyers directed students interested in being a participant in the study to use either a URL link or QR Code to access a Google Form linked to my UMB email account. The Google Form asked for the student's name, email address, phone number, school, grade, age and preferred language English, Spanish, or Portuguese. In addition, if students are under 18 years old, students were asked to provide a parent or guardian name, email address and contact phone number. Also, the student was able to indicate the preferred language of their parent or guardian.

The pre-notification letters for parental consent were available in English, Spanish, and Portuguese; these were the primary home languages of Black and Brown students who are classified as English Learners at both schools. Parental consent were returned by paper or online. Using multiple modes of communication such as emails, letters, and flyers with the participants helped minimize the logistics as well as the mode specific measurement error (de Leeuw, 2018). Also, pre-notification communication in various methods helped

minimize nonresponse rates. The participants were notified via their school-based email to complete the survey once parental consent was received, if needed.

If students were under 18 years old, an online parental consent form was sent to the parent's or guardian's email in the identified prefer language; English, Spanish, or Portuguese. Once the electronic signature of the parent or guardian was returned, the survey instrument was sent to the student participant via school-based and/or submitted email. Parental consent forms were available in hard copies as well at each school. After 48 hours if the parental consent form was not submitted, a reminder email was sent out to both to the potential participant and the parent or guardian email in the preferred languages. Reminders was be sent every 48 hours for two more times. After which if the consent form was not returned, the potential participant information was as interested but no parental consent for the duration of the study. If the student is at least 18 years old, the online consent form and the survey instrument link was directly to the participant school-based and/or provided email at the same time.

At the start of the online survey, participants acknowledged an inform consent statement outlining that completing this questionnaire was completely voluntary and that their consent was also voluntary. The statement explained that respondents are free to withdraw their consent at any time without consequence. Participants had to click a box to acknowledge receipt of the statement. The Spanish and Portuguese translation for the survey instrument, parental consent form, student assent form, and the flyer were produced using the translator application embedded in Microsoft Word software. The translation document versions were reviewed and edited by colleagues who first language is Spanish and Portuguese.

To collect the quantitative data, I used a list-based probability sample Web survey identified by Couper (2000) that was accessible via the participants smartphone devices. In the United States for example, based on a Pew Research Center study in 2018, 95% of American teens have access to a smartphone, with 45% of those teens indicating that they are online constantly (Anderson & Jiang, 2018). Students who did not have smartphones used their school issued Chromebooks, which were readily available within both schools. Because the online survey platform was able to adjust based on the device being used, the mode effect measurement error rate was not significant. As Tourangeau (2013) points out, the list-based probability sample Web survey sampling works well when a study is examining a population such as students within a school that has ready access to the Internet. Furthermore, to minimize population bias, I obtained the school-issued emails of all the students in the targeted grade-levels by working with the registrar office at the school. I used the students' emails to send survey pre-notifications and information regarding parental consent. This approach allowed me to receive high-quality surveys and cover almost all of the population (Tourangeau, 2013). In addition, the key requirements for a good sampling frame were covered as well, such as getting a high proportion of the targeted population, having no duplications since school issued emails are unique, and knowing that school emails are active for current enrolled students only.

The survey was designed on an online platform which took into account for the different smartphone screen sizes and features (Buskirk & Andrus, 2012). The web survey design advantages included graphic images that are sized and displayed according to the mobile web browser each participant is using, data and page loads that are faster; navigation buttons that are visible on each survey page, and page layouts that are optimized for the

number of questions on each page (Buskirk & Andrus, 2012). The survey was administered via the Qualtrics platform within the University of Massachusetts-Boston information technology services system which takes into account mobile devices online survey optimal features.

In order to maximize the participants response rate and minimize breakoffs rates, I kept the length of the survey short, made the survey interesting and relevant for the participants, provided incentives, and used research-based web survey design practices. The survey design and procedures ensured access for all participants, enabled willingness for students to participate, and guided the students through the actual participation (Couper et al., 2007). Since I was targeting high school students where both their attention span and social distractions can be an influenced on their survey response, I minimized the use of a scrolling design feature and optimized the use of section headers. I kept the number of survey questions to 60, where participants can complete the survey in 20 minutes or less. The design of the survey was optimized for smartphone devices. In addition, I mostly used in the Web survey design single response closed-ended radio buttons, thumb wheel, drop-down menu, and check all that apply question types. Only three open-ended questions were used and placed at the end of the survey to minimize the nonresponse and breakoff rate. Voice input was not required with mobile Web surveys which would eliminate the peer pressure of having the "wrong" or "right" answer (Fuchs, 2008). My assumption was that smartphone use in schools, specifically the ban use policy topic, was relevant and was a high salience topic to high school students, hence they were willing to participate in the study. Furthermore, I provided incentives for their participation.

The survey consisted of four sections with one of the sections pertaining to the demographic profile of the participants. The other three sections were organized around the tenets of culturally responsive teaching. The first section contained questions that examines the attitude of student using smartphone as an asset in their education. The second section contained questions that investigate students' attitude related to school policies of smartphone use. And the third section examined how students see smartphone use to remain connected to others, see Appendix B. And the final section collected demographic information of the participants. The draft of the survey questions was reviewed with a selected group of high school seniors to co-construct any changes needed for vocabulary usage, contextual phrases, and the overall structure of the survey.

This study involves high school teenagers who responses were submitted via a self-administered online survey. Parental consent was obtained by at least one parent or the legal guardian via online or hard copy. No waiver or alteration of the consent process was required for this study. Students who are wards of the state was not considered to be a part of the study. Participants received full assent statement at the beginning of the survey that required a click of a check box for acknowledgement and indication of understanding. Participants was able to complete the survey at a time and place that is convenient for them, however most participants completed the survey at school in their math class. The participation were free of peer pressure and coercion that can be caused by group or class settings in school. Each section instruction included a statement that any question can be skipped at any time if there are any discomfort in answering the question. The participants were asked to close their browser completely after completing the online questionnaire.

The only sensitive issue I anticipated was students answering the questions related to the severity of penalties they have had for using their mobile phone. When around their peers, students may find it cool to indicate that they got in trouble for using their smartphone in school. To validate the responses for this question I considered the open-respond question answers the students provided.

Invitations and Notifications. Invitations and notification reminder emails are tools that I used to maximize the participation rate. Using mixed mode such as email invitations and flyers throughout the school can made the invitation persuasive. And, I made person invitations to students at both schools in their math classes. Also, this helped with informing students that the survey will be coming from a legitimate source (Brenner, 2019). Students were invited to participate via a pre-notification email and flyer to their school-based email. Hard copies of the parental consent form in different languages were be available as well. Students received another email with the survey link and QR Code to the survey. I did not require the students to download any special app to complete the survey.

Incentives and Budget. I provided a $5 gift card to Dunkin Donuts for all students who complete the survey. Only 152 students who completed the survey provided information to receive their gift. So, the total I spent for this study on gifts was $760.

Data Analysis

Table 3.1 below summarizes the types of data that will address each research question and the data analysis used.

Table 3.1

Summary of Research Methods

Research Question	Data Collection	Data Analysis
To what extent do urban high school students believe smartphone technology can be useful in school and during remote learning?	Quantitative – Survey	Statistical Analysis – Descriptive/Inferential
	Qualitative – Open Response Question	Coding of Results and Qualitative Analysis
How do urban high school students perceive smartphone ban policies in schools?	Quantitative – Survey	Statistical Analysis – Descriptive/Inferential
	Qualitative – Open Response Question	Coding of Results and Qualitative Analysis
How do the attitudes about smartphone use in school and remote learning of urban high school students differs within the different gender, race/ethnicity, grade level, and technology ownership status?	Quantitative – Survey	Statistical Analysis – Descriptive/Inferential

Once approval was received from the University of Massachusetts Boston Institutional Review Board (IRB) and the Boston Public Schools IRB, the data collection process began. Email invitations were sent to all students' school email accounts at both participation sites in three languages. In addition, flyers were posted throughout the schools. Emails communication included a link to the participation registration form and the letter of informed consent for parents and guardians. Physical copy in all three languages were made available upon request. The letter of informed consent included the description of the study, statement of no risks to the participants, assurance of confidentiality, and an indication that participation in the study is voluntary. The letter of informed consent was provided via email, online or by a physical copy in the participants' guardians preferred language.

Prior to the data collection, the web survey was piloted by ten randomly selected ninth grade students to review the survey instruments and to provide feedback on the questions format and vocabulary of the survey. The students in the pilot group were asked to provide feedback on the phrases used, vocabulary, and overall context of the questions. Revisions and additions were made to further clarify some of the questions based on the students' feedback.

The initial phase of data analysis involved descriptive data analysis of the participants demographic and technology of choice. Charts and tables were used to report the findings. The next phase included descriptive and inferential data analysis of the quantitative data collected from the survey questions. T-tests and ANOVA tests were conducted as well and the relevant findings within this data were reported as tables, charts and graphs. The third phase of the data analysis involved coding of the statements from the open-response questions of the survey. The emerging themes from the participants' responses were identified, described, and reported through tables, charts and student quotes. The final data analysis phase included comparing the survey questions results with the open-response quantitative data to provide the overall explanation of the findings of the study.

The quantitative data was analyzed and summarized using the SPSS software tool. SPSS software was accessed through the University of Massachusetts Boston online application tools available to graduate students. Researchers acquire knowledge about people, objects, events, and process by observing and measuring them (DeVellis, 2017). Making sense of what is being observed or measured usually requires quantifying the information in some form (DeVellis, 2017). "A survey design provides a quantitative description of trends, attitudes, and opinions of a population, or tests for associations among

variables of a population, by studying a sample of that population" (Creswell, 2017). The questions constructed from the tenets within CRC provided descriptive and relationships measurements by means of a Likert-scale for questions on the survey related to the indicators. All data collected was entered into SPSS with a number identification, so no student names or the name of the schools were identified with the data. I followed the research tips outlined by Creswell (2017) when analyzing the quantitative data.

In the first step, I recorded the number of participants who completed the survey and the numbers of participants who did not respond, based on the grade enrollment data from each school. In the next step, I determined the response bias —the effect on the results based on if the students who did not complete the survey had actually completed it. The next step I used IBM SPSS software to provide descriptive statistics for each indicator in the study, which included the central tendency measurements, the means, median, and mode, and the variability, the standard deviations and range, to analyze the variables. Also, variables were correlated using the t-test and ANOVA to measure the strength of the relationship between the variables. In addition, missing data was analyzed to determine the effects on the findings. In the final step presented the results using tables and graphs. In addition, I analyzed the written responses to the open-response questions. Using a coding process, I identified emerging themes based on students' written responses. I compared these themes with the quantitative Likert-scale results.

The quantitative data and open-response themes were used to come to understand students' realities as related to smartphone use in education. This approach allowed me as the researcher to raise questions on the assumptions about the effectiveness of smartphones in urban schools (Mertens, 2007). I seek to understand the cultural norms and experiences of

the students who are using smartphone every day and how their usage relates to their education.

Data Validity and Reliability

The three tradition ways to establish the validity of quantitative data to make meaningful inferences from the information are content validity, predictive validity, and construct validity (Creswell, 2017). Content validity looks at whether the survey questions measure what they are intended and designed to measure. Predictive validity looks at whether the results correlates with other results. And construct validity looks at whether the survey questions measure hypothetical constructs or concepts. I used face-validity and content-validity tests to measure the validity of data.

Reliability looks at how consistent or repeatable is the research instrument (Creswell, 2017). Within a multi-item instrument like a survey, the internal consistency is an important form of reliability measurement. Internal consistency looks at the degree in which items within the instrument behave the same way (Creswell, 2017). I used the Cronbach's Alpha test to measure the internal consistency reliability of each subcategory variable within the survey.

Ethical Considerations

All participants received an informed consent form prior to participating in the study. The informed consent form indicated that their participation is voluntary and that they can opt out of the study at any time. If the participants were under the age of 18-year-old, their parents or guardians received the informed consent form as well. The participants' privacy was maintained throughout the study and their responses in the survey were not linked to their identity in any way.

The URL link or QR Code to the questionnaires was emailed to the participants via their school based and/or provided email. The questionnaire itself did not ask the participant to provide their name, email address or any other personally identifying information. At the completion of the questionnaire that respondents were asked to provide their name, email address and phone number to receive a $5.00 gift card to Dunkin Donuts for completing the survey.

All surveys responses were entered in the SPSS database, assigning each survey a number when completed and submitted. Because the survey must be completed to receive the gift card, I knew which participant completed the survey for gift cards. Participants personal information submitted for the gift cards was kept separate on a Microsoft Excel database file and remain confidential and managed only by me, the principal researcher for this study. Also, the personal information obtained by potential participants was kept in a separate Microsoft Excel database as well access only by me the principal researcher. No other person had access to any personal information that is not publicly available through the participants schools. All information was kept confidential on an external hard drive.

Limitations of Study

The generalization of the results of this study may have been impacted by the limitations of this study. First, the sample size of students with disabilities or reported as having disabilities is not reflected of the students with disabilities population size of the school district in which the study was conducted. Second, the participants were high school students who provided self-reported data. This study depended on high school students to give a thoughtful account on their actual experience with smartphone use in school. There were no in-school reports to verify their responses. Third, during the study, almost all of the

participants completed the survey at school within a group or classroom setting; participants answers could have been influenced by their peers. Future research using small focus group interviews is needed to further verify and validate participants responses. And lastly, the study was conduct through a descriptive method using a questionnaire versus an experimental research method without a control group in one urban school district. Therefore, the generalization of the results may not be reflected of high school students around the nation outside of urban school districts.

Using a quantitative research methodology for this study within a high school setting, the limitations of the results may be impacted by response and confirmation biases. Participants of this study are high students who oftentimes deal with peer pressure and a sense of belonging within groups. As a result, the participants' responses to the survey instrument have the potential to be influenced by their peers. Secondly, I am currently working in a high school setting as an administrator and have previous experience teaching in the classroom. Oftentimes, I have to and had to respond to students' smartphone use in school and in classrooms. The creation of the questions for this research study and the analysis of the responses can be influenced by my experiences as a teacher and as a school administrator. To minimize the impact of these biases, I use appropriate statistical tests, use clear and neutral non-leading questions, and compare the results of the Likert-scale type questions with the open-response questions responses by the participants.

Summary

High school students are constantly on their smartphones. This research study was designed using a quantitative approach to determine whether urban schools are missing an opportunity to further engage and involve students in the learning process with their

technology of choice. By utilizing the tenets of culturally responsive computing, students' perspectives were the center of the data collected in this study. The findings not only added students' voices in the conversation related to technology use policies in schools but also provided opportunities for students to co-create effective use of smartphones technology for educational purposes. I hope that the findings in this study further pave a way for dialogue and positive actions that can be beneficial to both students and our educational system.

CHAPTER 4

FINDINGS

**"Education is the great American adventure,
the world's most colossal democratic experiment."
-Mary McLeod Bethune**

Introduction

The purpose of the study was to evaluate the use of and the attitude towards smartphone technology for in school and remote learning by urban high school students to reduce the digital inequalities. The study involved an online web survey which explored students' use and attitudes in three areas: usefulness of smartphones for school, students' beliefs and understanding of smartphone policies in school, and how smartphones for student enables connections.

This chapter contain the participants demographics such as their grade, age, gender, race/ethnicity, whether or not participants have a learning disability, types of technology participants have accessible at home and at school, technology most frequently use, and how much time spent is internet related activities. Descriptive statistics were computed to determine frequencies, means, and standard deviations for each of the survey questions. Further quantitative analysis was conducted to measure student's responses in the three areas of usefulness, beliefs, and connections. The survey and responses will be explored in terms of reliability, central tendency, and correlation of means, using t-tests, ANOVA, and chi square tests. The following research questions guided the analysis:

- To what extent do urban high school students believe smartphone technology can be useful in school and during remote learning?
- How do urban high school students perceive smartphone ban policies in schools?

- To what extent do urban high school students use their smartphone to stay connected to school, home, and their communities.
- How do the attitudes about smartphone use in school and remote learning of urban high school students differ within the different gender, race/ethnicity, grade level, and disabilities?

Characteristics of Participants

Responses to the self-designed online web survey were collected from 202 high school student participants at two high schools, Eastside High School and Westside High School. Of these students, 186 answered every question in the survey. The participant dropout mostly began at the start of section two on question 20 of the survey. Of the 202 participants, Eastside High School had 44.1 % (N=89), Westside High School also had 44.1% (N=89), and 11.9% (N=24) of participants did not indicate their high school. The study included 85 female participants (42.1%), 88 male participants (43.6%), and 29 participants choosing not to answer or responded as non-binary (14.4%). The study included 20.3% of 9th graders, 35.6% of 10th graders, 11.9% of 11th graders, and 18.3% of 12th graders. Of the participants, 77 classified themselves as Black/African-American (38.1%), 53 as Hispanic/Latinx (26.2%), 17 as Mixed (8.4%), 6 as Asian/Pacific Islander (3.0%), and 49 indicated not listed or prefer not to answer (24.4%). See Figures 4-1 thru 4-4 below. Also, only 10 (5%) survey participants indicated they had either a physical or learning disability.

Figure 4-1

Study Participants Percentages by School

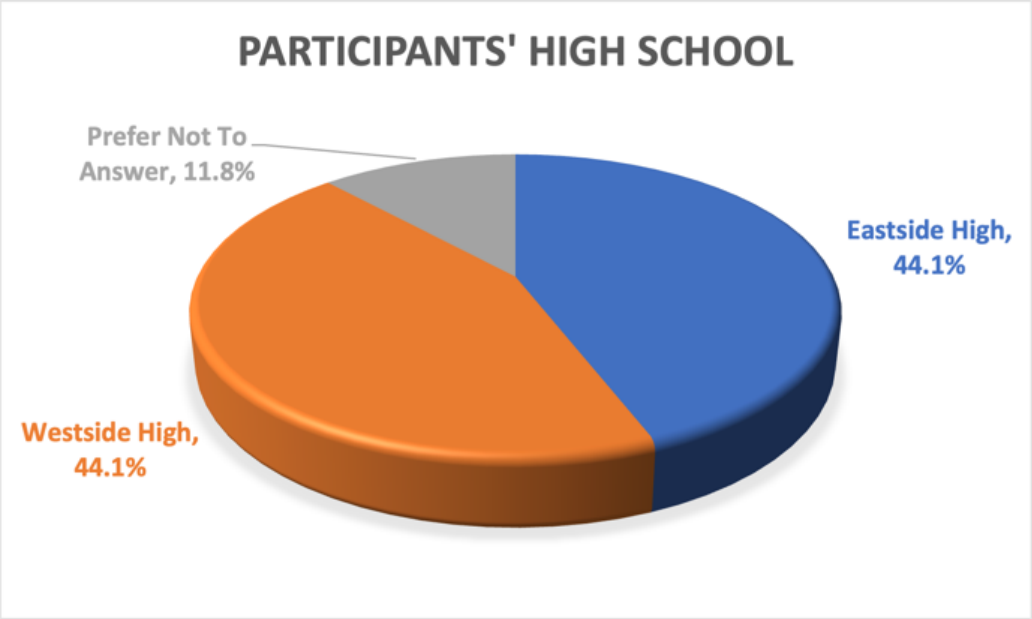


Figure 4-2

Study Participants Percentages by Gender

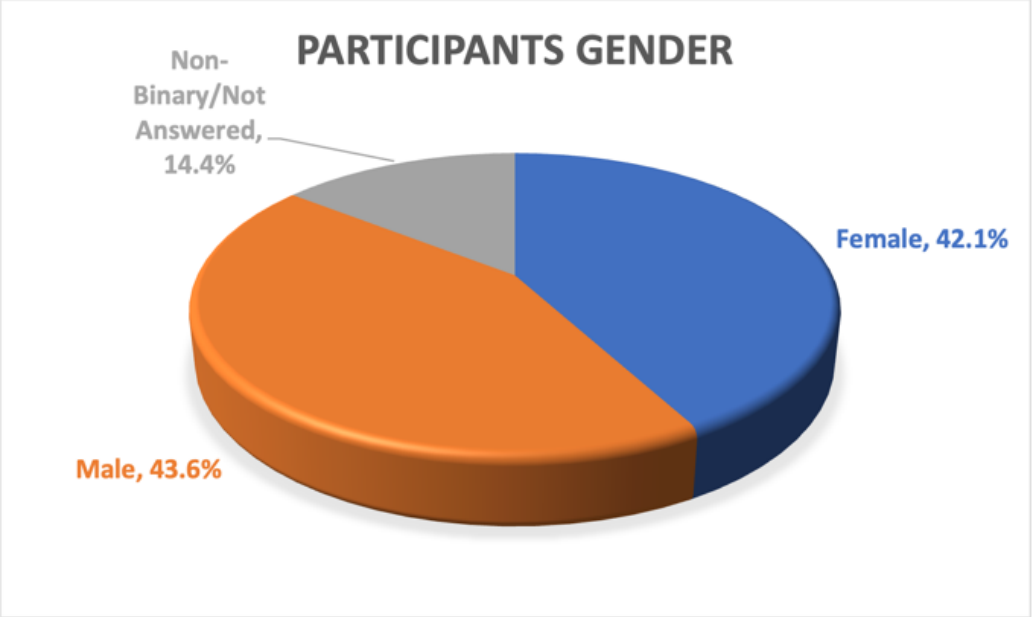


Figure 4-3

Study Participants Percentages by Grade Levels

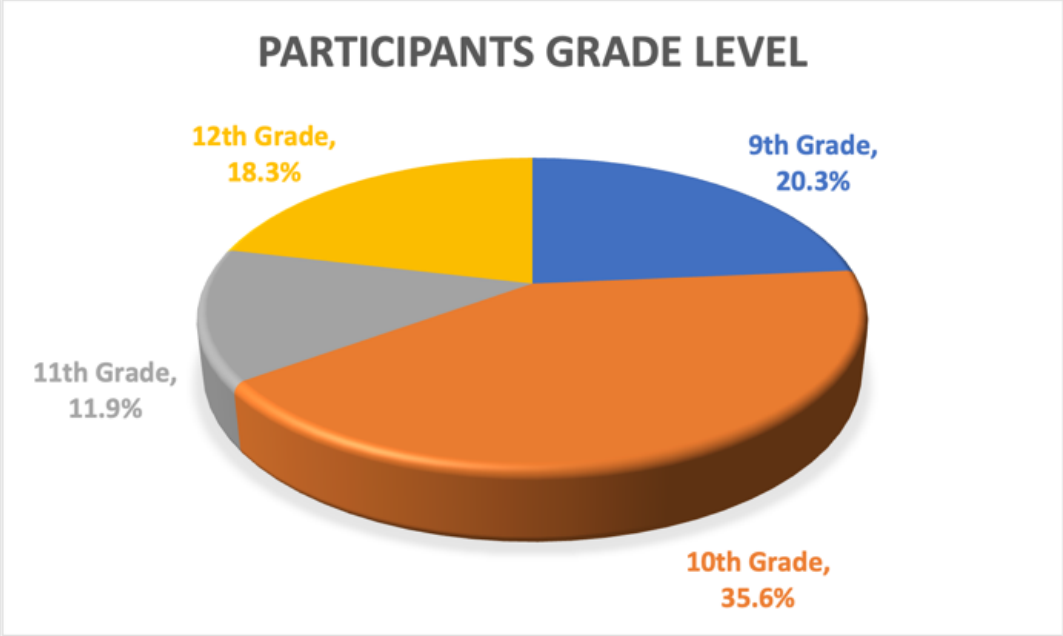
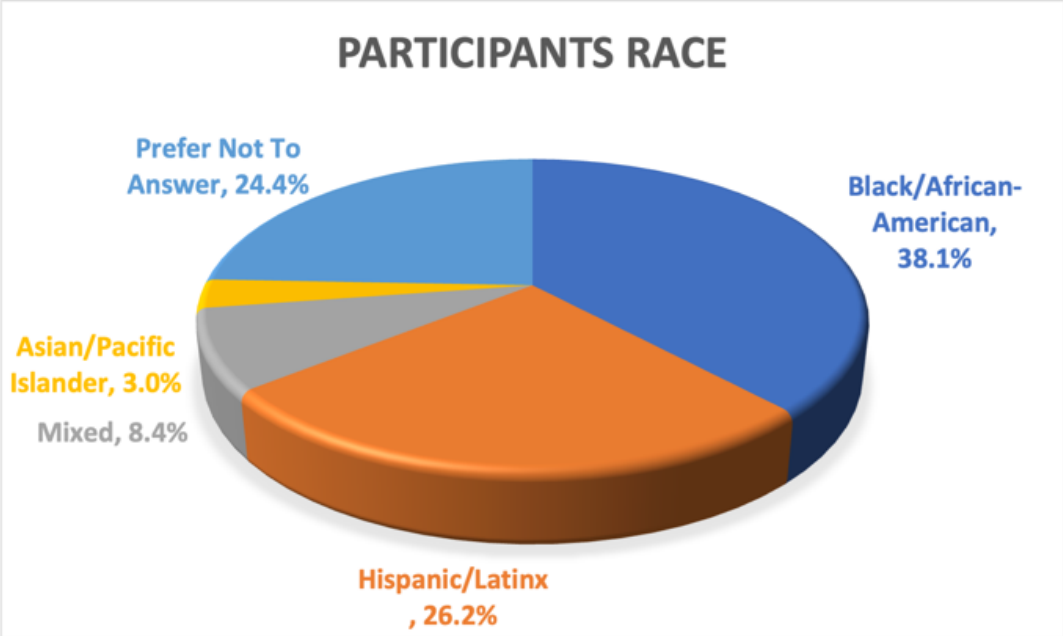


Figure 4-4

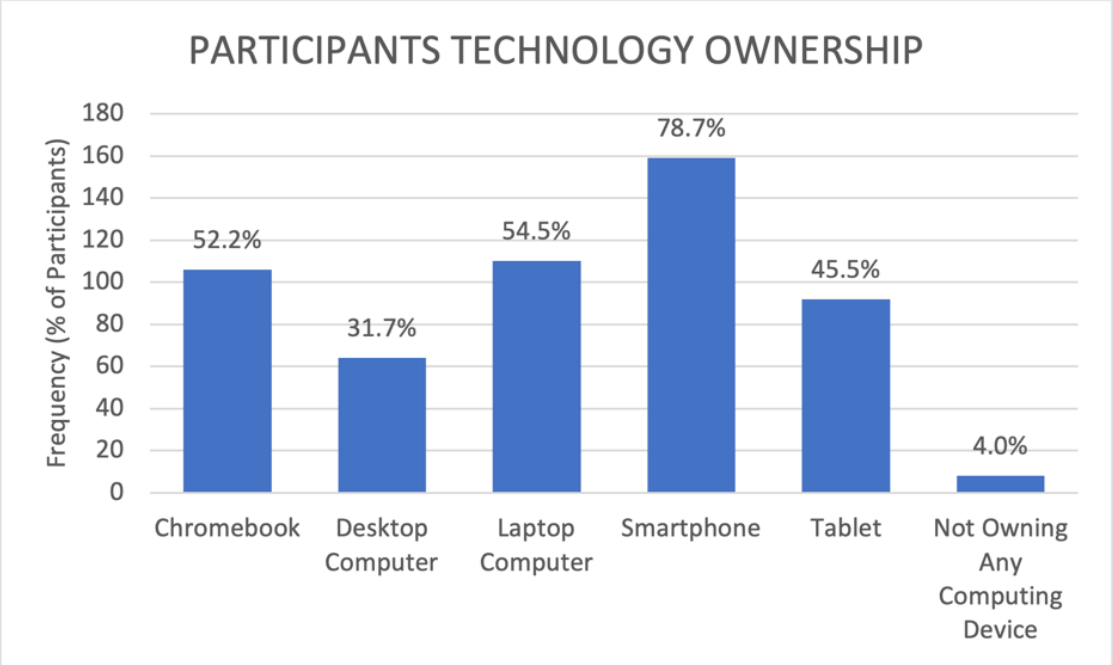
Study Participants Percentages by Race/Ethnicity



In terms of technology ownership by the participants or their family, 52.5% of participants indicated ownership of Chromebook technology, 31.7% indicated ownership of Desktop Computer technology, 54.5% indicated ownership of Laptop Computer technology, 78.7% indicated ownership of Smartphone technology, 45.5% indicated ownership of Tablet Device technology, and 4.0% indicated not owning any computing devices (See Figure 4-5 below). When asked whether participants had access to technology at their school, 80.7% indicated that they have access to Chromebook technology, 20.3% indicated having access to Desktop Computer technology, 23.8% indicated having access to Laptop Computer technology, and 14.4% indicated having access to Tablet Device technology.

Figure 4-5

Technology Ownership of Participants Percentages



As current research shows, almost all high school students have access to a technology computing device with smartphones being available by most students. Although many students indicated they own laptop computers and tablets, the vast majority of students do not bring them to school or have indicated that these devices are not their preferred technology. This could be a result of their laptop and tablet technology being out-of-date or due to the access restrictions on internet connections for personal devices at school. Furthermore, most schools have been successful in deploying Chromebook technology to students as part of their one-to-one technology programs, so it surprising to see such a high personal ownership rate for Chromebooks.

Of the participants who answered the question, 'Which device do you use most frequently to access the Internet?', 78.8% indicated that they use their Smartphone technology. Slightly over 37% indicated that they spend more than 5 hours on Internet-related activities, such as email, browsing, social media, etc. on average per day (See Tables 4-1 and 4-2 below).

Table 4-1

Participants Devices Used the Most Frequently

Which device do you use most frequently to access the Internet?		
Technology Device	*f*	*%*
Chromebook	19	9.4
Desktop Computer	4	2.0
Laptop Computer	12	5.9
Smartphone	141	69.8
Tablet Device (e.g. iPad)	1	0.5
Do NOT use any computing device	2	1.0

Did Not Answer	23	11.4
Totals	202	100

Table 4-2

Participants Time Spent on Internet-related Activities

On average, how much time do you spend per day on Internet-related activities (email, browsing, social media, etc.)?		
Time	Frequency	Percentage
Less than 1 hour	3	1.5
About 1 to 2 hours	29	14.4
About 3 to 5 hours	68	33.7
More than 5 hours	76	37.6
Do NOT spend any time	3	1.5
Did Not Answer	23	11.4
Totals	202	100

It is not surprising that high school students spend more time on the smartphone during the day than any other technology device. Smartphones' mobility, ease of access, constant connection to the internet, and ease of use make it the idea technology for teenagers.

Now consider the participants technology ownership by disabilities, race, gender, and grade levels, which was self-reported in Section 4 of the survey instruments. Amongst the students with disabilities, 90% indicated ownership of smartphone technology. The majority of students with disabilities indicated ownership of Chromebook, desktop computers, laptop computers and tablet devices as well. In comparison, slightly over 80% of Asian and Black/African-American students and all Hispanic/LatinX students indicated owning

smartphone technology. As for ownership of desktop computers, less than 50% of students across all race/ethnicity categories owned a desktop, however over 70% of students with disabilities owned desktop computers (See Table 4-3 below).

Table 4-3

Technology Ownership by Disability and Race/Ethnicity

Technology	Dis*	Race/Ethnicity				
		Asian	Black	Hisp	Mixed	NL
N	10	6	77	53	17	24
Chromebook	80.0%	50.0%	62.3%	60.4%	64.7%	45.8%
Desktop Computer	70.0%	16.7%	32.5%	45.3%	35.3%	29.2%
Laptop Computer	70.0%	66.7%	55.8%	62.3%	64.7%	70.8%
Smartphone	90.0%	83.3%	80.5%	100%	94.1%	87.5%
Tablet Device	60.0%	50.0%	49.4%	47.2%	70.6%	50.0%
None	10.0%	16.7%	2.6%	1.9%	0.0%	16.7%

*Note: Dis=Students with disabilities, Asian=Asian/Pacific Islander, Black=Black/African-American, Hisp=Hispanic/LatinX, Native=Native American/American Indian, NL=Prefer not to Answer/Not Listed

With respect to technology ownership across genders, male students own Chromebooks and desktop computers by about 8% higher than female students, but their ownership of smartphones and tablet devices is about 6~8% lower than female students See Table 4-4 below. In terms of grade levels (see Table 4-5 below), more 9th grade students indicated ownership of Chromebook technology while indicating similar ownership rates with other grades for other technology. Fairly low percentages of 10th and 12th grade students indicated ownership of desktop computers. All grade levels indicated higher percentages for smartphone ownership by more than 15% when compared to any other technology.

Table 4-4

Technology Ownership by Gender

Technology	Gender		
	Female	Male	Non-Bi
N	85	88	4
Chromebook	55.3%	63.6%	75.0%
Desktop Computer	31.8%	39.8%	25.0%
Laptop Computer	61.2%	61.4%	50.0%
Smartphone	91.8%	85.2%	100.0%
Tablet Device	54.1%	46.6%	75.0%
None	3.5%	5.7%	0.0%

Note: Non-Bi=Non-Binary/Prefer Not Answer

Table 4-5

Technology Ownership by Grade Level

Technology	Grade Levels			
	9th	10th	11th	12th
N	41	72	24	37
Chromebook	70.7%	62.5%	50.0%	43.2%
Desktop Computer	46.3%	33.3%	45.8%	21.6%
Laptop Computer	65.9%	61.1%	45.8%	67.6%
Smartphone	87.8%	90.3%	87.5%	91.9%
Tablet Device	48.8%	54.2%	41.7%	56.8%
None	4.9%	5.6%	4.2%	2.7%

Next consider participants technology device used on frequently to access the internet by disabilities, race, gender and grade levels. As shown on Table 4-6 to Table 4-8, all students prefer using their smartphone technology to access the internet. When considering the other technology, 30% of students with disabilities prefer using their desktop computer while about 17% of Black/African-American students prefer using their Chromebooks. About 11% of male and female students prefer using their Chromebook technology to access

the internet. About 15% of 10th grade students prefer using their Chromebook while 11% of 12th grade students prefer using their laptop computers to access the internet.

Table 4-6

Device Most Frequently Used for Internet by Disability and Race/Ethnicity

Technology	Dis*	Race/Ethnicity		
		A/M/NL*	Black	Hisp
N	10	39	77	53
Chromebook	0.0%	2.5%	16.9%	5.7%
Desktop Computer	30.0%	5.1%	2.6%	0.0%
Laptop Computer	10.0%	2.5%	9.1%	5.7%
Smartphone	50.0%	82.1%	71.4%	88.7%
Tablet Device	0.0%	2.5%	0.0%	0.0%
None	10.0%	5.1%	0.0%	0.0%

*Note: Dis=Students with disabilities, A/M/NL =Asian/Pacific Islander; Mixed; Not Listed, Black=Black/African-American, Hisp=Hispanic/LatinX.

Table 4-7

Device Most Frequently Used for Internet by Gender

Technology	Gender		
	Female	Male	Non-Bi
N	85	88	2
Chromebook	10.6%	11.4%	0.0%
Desktop Computer	0.0%	6.1%	0.0%
Laptop Computer	5.9%	6.8%	0.0%
Smartphone	82.4%	75.0%	100.0%
Tablet Device	0.0%	1.1%	0.0%
None	1.2%	1.1%	0.0%

Note: Non-Bi=Non-Binary/Prefer Not Answer

Table 4-8

Device Most Frequently Used for Internet by Grade Level

Technology	Grade Levels			
	9th	10th	11th	12th
N	41	72	24	37
Chromebook	7.%	15.3%	8.3%	5.4%
Desktop Computer	4.9%	2.8%	0.0%	0.0%
Laptop Computer	2.4%	6.9%	0.0%	10.8%
Smartphone	82.9%	73.6%	91.7%	81.1%
Tablet Device	2.4%	0.0%	0.0%	0.0%
None	0.0%	4.2%	0.0%	2.7%

To compare technology ownership versus students' preferred technology to connect to the internet, Figures 4-6 and 4-7 are charts for portable technology in which students would most likely be able to carry with them to school; smartphones, web tablets, and laptop computers. Over 50% of students across all demographics indicated ownership of a smartphone, web tablet, and laptop computer except for males, Black/African-Americans, Hispanics/LatinX, 9th graders and 11th graders who web tablet ownership falls slightly below 50%. Percentage of smartphone ownership far exceeds web tablets and laptops computers for all demographics except for students with disabilities. But when looking at which portable device students are most likely to use to connect to the internet, on average over 75% of students in all demographics indicated their smartphone, except for students with disabilities which was about 50%. Web tablets and laptop computers were between 0% and 10%. Students clearly prefers using their smartphones to connect to the internet. This could also be an indication of the added cost needed to connect web tablets and laptop computers to the network via internet providers versus cellular phone providers. Families of low

socioeconomical status are more likely to have cellular phone accounts over the internet provider accounts.

Figure 4-6

Technology Ownership Across Demographics

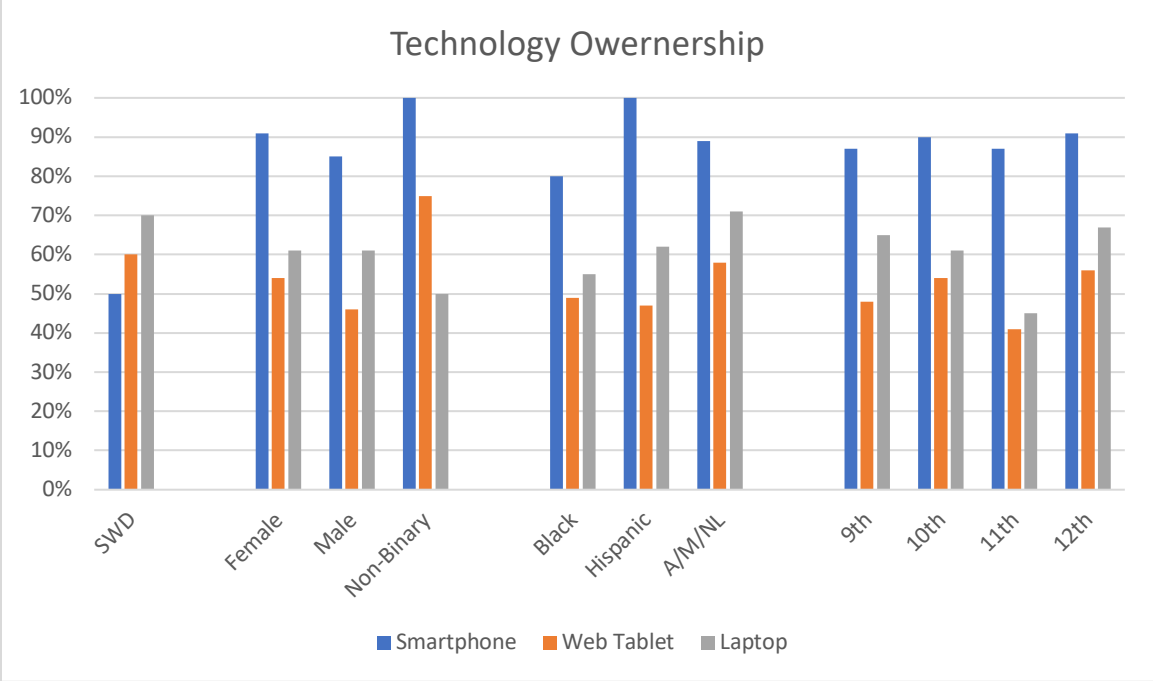
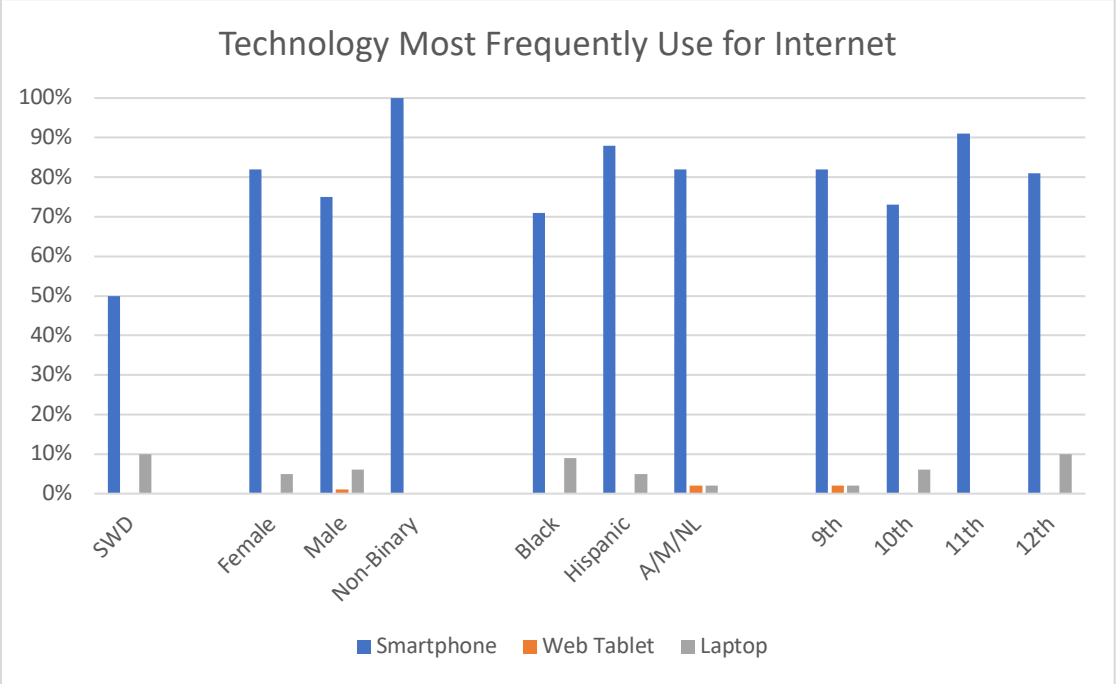


Figure 4-7

Technology Most Frequently Used for Internet Across Demographics



When asked how much time do the participants spend per day on the internet, over 70% of students are spending more than 3 hours per day on the internet. On average about 40% are spending more than 5 hours on the internet per day. Students with disabilities and Black/African-American indicated spending the most time on the internet per day as well as 11th and 12th grade students. See Tables 4-9, 4-10, and 4-11.

Table 4-9

How Much Time per Day on the Internet by Disability and Race/Ethnicity

Technology	Dis*	Race/Ethnicity		
		A/M/NL*	Black	Hisp
N	10	39	77	53
Less than 1 hour	0.0%	2.6%	2.6%	0.0%
About 1 to 2 hours	20.0%	10.3%	18.2%	32.5%
About 3 to 5 hours	40.0%	46.2%	32.5%	45.3%
More than 5 hours	40.0%	38.5%	45.5%	37.7%
None	0.0%	2.6%	1.3%	1.9%

*Note: Dis=Students with disabilities, A/M/NL =Asian/Pacific Islander; Mixed; Not Listed, Black=Black/African-American, Hisp=Hispanic/LatinX.

Table 4-10

How Much Time per Day on the Internet by Gender

Technology	Gender		
	Female	Male	Non-Bi
N	85	88	2
Less than 1 hour	1.2%	2.3%	0.0%
About 1 to 2 hours	11.8%	20.5%	0.0%
About 3 to 5 hours	43.5%	33.0%	50.0%
More than 5 hours	43.5%	40.9%	50.0%
None	0.0%	3.4%	0.0%

Note: Non-Bi=Non-Binary/Prefer Not Answer

Table 4-11

How Much Time per Day on the Internet by Grade Level

Technology	Grade Levels			
	9th	10th	11th	12th
N	41	72	24	37
Less than 1 hour	0.0%	1.4%	8.3%	0.0%
About 1 to 2 hours	14.6%	20.8%	8.3%	13.5%
About 3 to 5 hours	51.2%	37.5%	29.2%	32.4%
More than 5 hours	34.1%	38.9%	54.2%	51.4%
None	0.0%	1.4%	0.0%	2.7%

Over a third of students across all demographics indicated spending more than 5 hours per day on the internet with their smartphones. This time on the internet more than likely is for social activities and games since during school students are asked to put their smartphones away. The percentages of students in 9th and 10th grade as well as Hispanic/LatinX students spending more than 5 hours per day on the internet are less than the other demographics.

Figure 4-8

Percentage of Students Spending More Than 5 Hours on Internet by Demographics

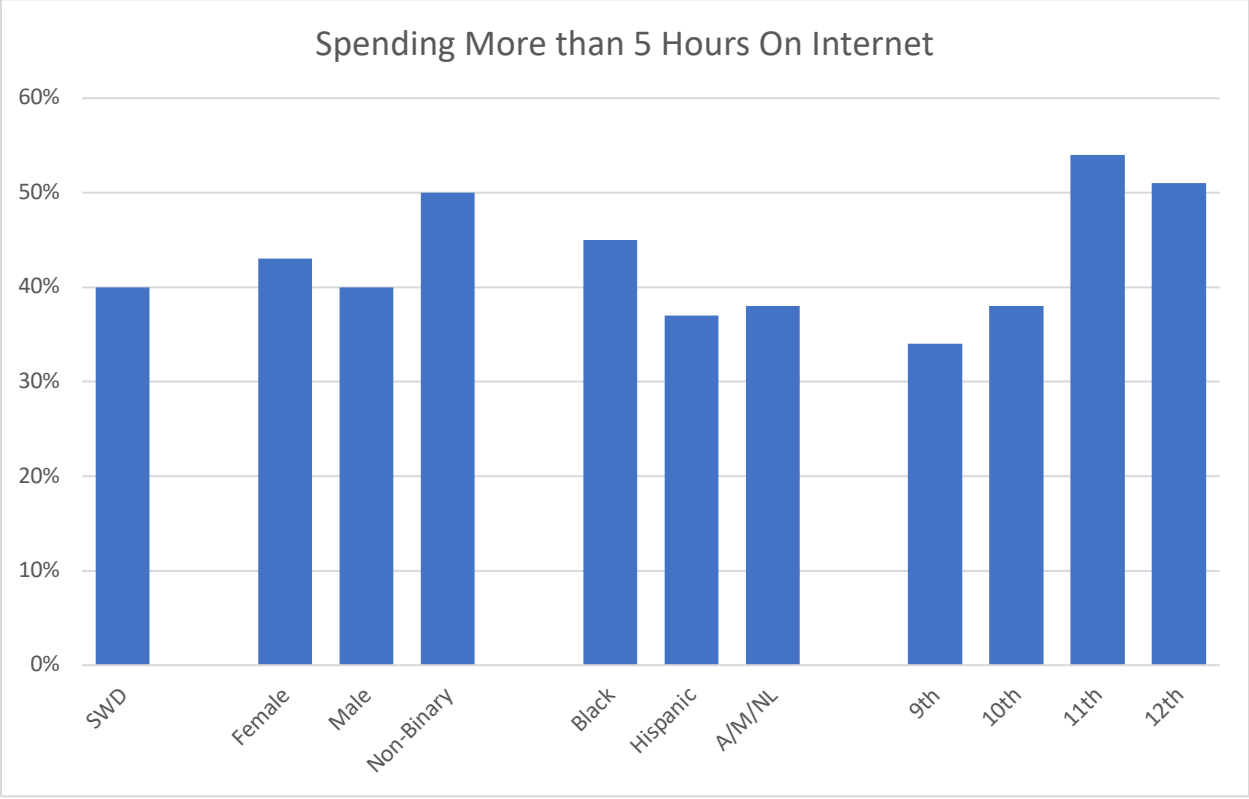


Table 4-12 through Table 4-14 below shows the percentages of students by disabilities, race/ethnicity, gender, and grade levels who have taken a course or class online before. Table 4-15 through Table 4-18 shows students' current course grades in the core subjects of ELA/ESL, History, Math, and Science, broken down by disability, gender, race/ethnicity, and grade levels.

Over 70% of all students indicated that they have taken a class online before. Amongst the male students, 6% more than female students have taken a class online before. Black students and students in the 12th grade show the highest percentage of 79.7% and 83.8% respectively. This could be the result of students taking online courses to recover credits for graduation requirement from failing grades from previous years in high school. Over 80% of the students with disabilities reported scoring at or above average in all of their core courses except for Math, where only 70% was reported. Female students report scoring at or above average slightly more than male students in all of their core courses except for Math, where both Female and Male students reported about the same. Hispanics/LatinX students reported having a lower at or above average score in all core courses than Black students, a difference of slightly more than 10%. This difference could be the result of the higher number of multilingual students within Hispanics/LatinX who tend to enroll in school mostly during the middle of the school year. In terms of grade-level, 10th and 12th grade students are reporting having the most challenges in passing their core courses at or above average. Usually in the 10th grade, the core courses content complexity increases exponentially from the 9th grade. On the other hand, in 12th grade, some students tend to lose motivation if they have too many credits to recover from previous failing grades or due to life situations changes from social determinants.

Table 4-12

Ever Taken a Course/Class Online by Disability and Race/Ethnicity

Technology		Dis*	Race/Ethnicity		
			A/M/NL*	Black	Hisp
	N	10	39	74	53
Yes		70.0%	74.4%	79.7%	73.6%
No		30.0%	23.1%	18.9%	24.5%
Prefer Not to Ans		0.0%	2.6%	1.4%	1.9%

*Note: Dis=Students with disabilities, A/M/NL =Asian/Pacific Islander; Mixed; Not Listed, Black=Black/African-American, Hisp=Hispanic/LatinX.

Table 4-13

Ever Taken a Course/Class Online by Gender

Technology		Gender		
		Female	Male	Non-Bi
	N	83	87	2
Yes		73.5%	79.3%	100.0%
No		24.1%	20.7%	0.0%
Prefer Not to Ans		2.4%	0.0%	0.0%

Note: Non-Bi=Non-Binary/Prefer Not Answer

Table 4-14

Ever Taken a Course/Class Online by Grade Level

Technology		Grade Levels			
		9th	10th	11th	12th
	N	39	71	24	37
Yes		76.9%	74.6%	70.8%	83.8%
No		23.1%	21.1%	29.2%	16.2%
Prefer Not to Ans		0.0%	4.2%	0.0%	0.0%

Over 70% of students across all demographics indicated have taken an online course before (See Figure 4-9). This large reported percentage is an indicator that students are comfortable of using technology for educational purposes. The non-binary gender students

show 100%, however this increased difference may be the result of the population size being significantly lower than the other demographic groups.

Figure 4-9

Percentage of Students Taken an Online Course by Demographics

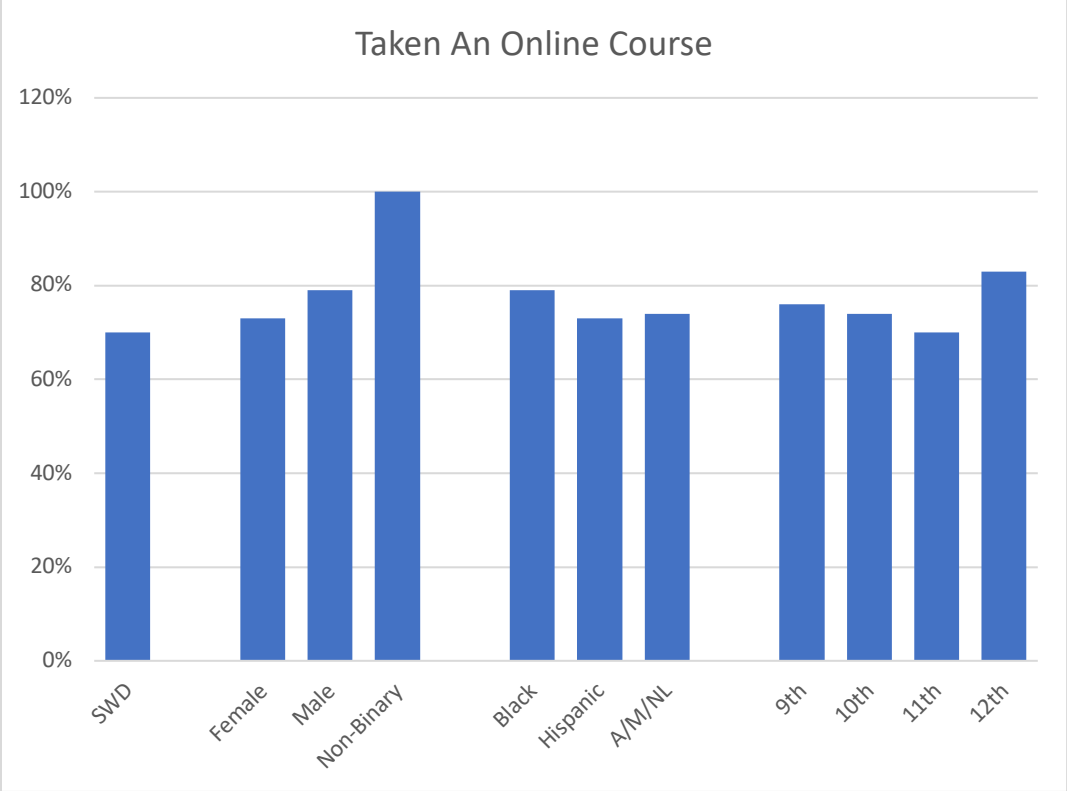


Table 4-15

Current Grades in Core Subjects for Students with Disabilities

Core Subjects	N	Current Grades				
		A	B	C	D	F
ELA/ESL	10	0.0%	80.0%	10.0%	10.0%	0.0%
History	10	20.0%	30.0%	30.0%	10.0%	10.0%
Math	10	20.0%	20.0%	30.0%	30.0%	0.0%
Science	10	30.0%	60.0%	10.0%	0.0%	0.0%

Table 4-16

Current Grades in Core Subjects by Gender

Core Subjects	Gender	N	Current Grades				
			A	B	C	D	F
ELA/ESL	**Female**	80	38.8%	33.8%	15.0%	5.0%	7.5%
	Male	87	32.2%	29.9%	23.0%	11.5%	3.4%
	Non-Bi	2	100%	0.0%	0.0%	0.0%	0.0%
History	**Female**	75	41.3%	29.3%	14.7%	8.0%	6.7%
	Male	84	36.9%	23.8%	21.4%	10.7%	7.1%
	Non-Bi	2	100.0%	0.0%	0.0%	0.0%	0.0%
Math	**Female**	79	34.2%	31.6%	12.7%	15.2%	6.3%
	Male	87	29.9%	23.0%	27.6%	17.2%	2.3%
	Non-Bi	2	100.0%	0.0%	0.0%	0.0%	0.0%
Science	**Female**	78	30.8%	39.7%	19.2%	5.1%	5.1%
	Male	86	25.6%	34.9%	23.3%	10.5%	5.8%
	Non-Bi	2	100.0%	0.0%	0.0%	0.0%	0.0%

Table 4-17

Current Grades in Core Subjects by Race/Ethnicity

Core Subjects	Race/Eth	N	Current Grades				
			A	B	C	D	F
ELA/ESL	**A/M/NL***	38	34.2%	31.6%	26.3%	5.2%	2.6%
	Black	76	40.8%	31.6%	17.1%	7.9%	2.6%
	Hisp	50	36.0%	32.0%	12.0%	10.0%	10.0%
History	**A/M/NL***	34	38.2%	17.6%	29.4%	5.9%	8.8%
	Black	73	41.1%	32.9%	12.3%	11.0%	2.7%
	Hisp	49	42.9%	24.5	14.3%	6.1%	12.2%
Math	**A/M/NL***	37	48.6%	24.3%	10.8%	16.2%	0.0%
	Black	75	30.7%	28.0%	28.0%	12.0%	1.3%
	Hisp	51	25.5%	31.4%	13.7%	19.6%	9.8%
Science	**A/M/NL***	37	32.4%	37.8%	16.2%	5.4%	8.1%
	Black	74	29.7%	40.5%	18.9%	9.5%	1.3%
	Hisp	50	28.0%	34.0%	24.0%	6.0%	8.0%

*Note: A/M/NL =Asian/Pacific Islander; Mixed; Not Listed, Black=Black/African-American, Hisp=Hispanic/LatinX.

Table 4-18

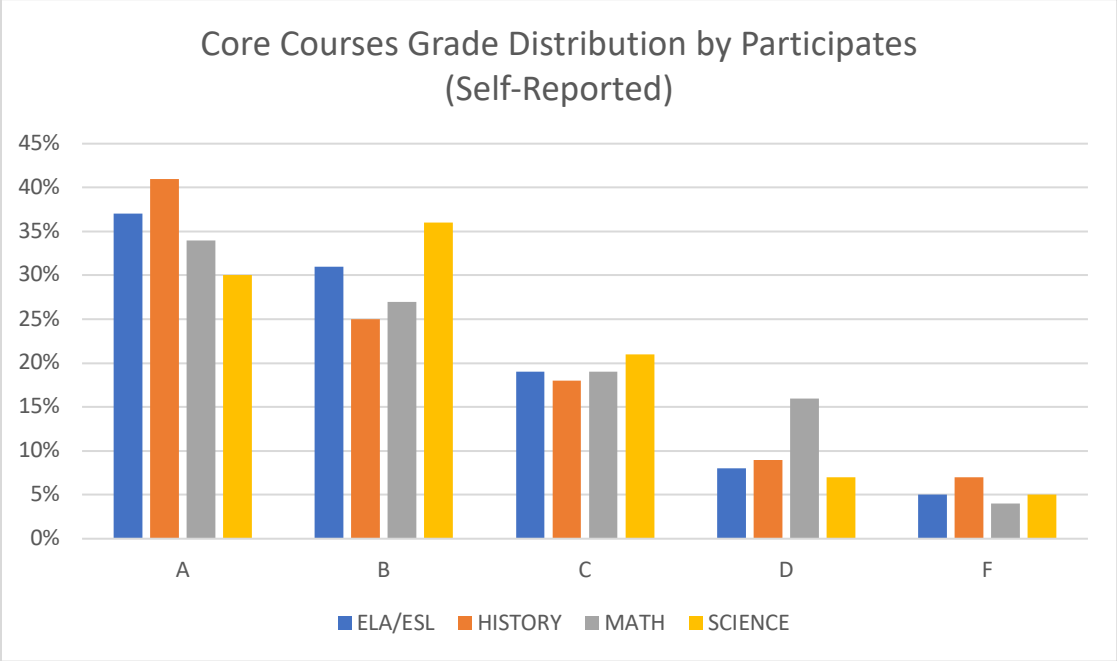
Current Grades in Core Subjects by Grade Levels

Core Subjects	Grade Level	N	Current Grades				
			A	B	C	D	F
ELA/ESL	**9th Grade**	40	42.5%	32.5%	17.5%	2.5%	5.0%
	10th Grade	70	37.1%	30.0%	17.1%	8.6%	7.1%
	11th Grade	22	22.7%	31.8%	31.8%	13.6%	0.0%
	12th Grade	35	37.1%	28.6%	17.1%	11.4%	5.7%
History	**9th Grade**	36	50.0%	22.2%	11.1%	8.3%	8.3%
	10th Grade	69	42.0%	23.2%	18.8%	5.8%	10.1%
	11th Grade	22	45.5%	22.7%	22.7%	9.1%	0.0%
	12th Grade	32	25.0%	31.3%	21.9%	18.8%	3.1%
Math	**9th Grade**	40	30.0%	27.5%	27.5%	15.0%	0.0%
	10th Grade	69	44.9%	17.4%	17.4%	14.5%	5.8%
	11th Grade	22	13.6%	36.4%	22.7%	27.3%	0.0%
	12th Grade	35	28.6%	37.1%	11.4	14.3%	8.6%
Science	**9th Grade**	40	30.0%	40.0%	22.5%	5.0%	2.5%
	10th Grade	70	27.1%	38.6%	18.6%	4.3%	11.4%
	11th Grade	22	27.3%	36.4%	9.1%	13.6%	0.0%
	12th Grade	32	37.5%	25.0%	25.0%	12.5%	0.0%

The self-reported grade distribution of core courses at the time to the survey shows that over 93% of students report receiving a passing grade in their core courses. More students indicated earning an A in science than the other core course however at the same time receiving more F, about 40% and 7% respectively. More students indicated earning a B or a C in science over the other core courses, about 35% and 20% respectively. At about 15%, more students indicated earning a D in math when compared to the other core courses.

Figure 4-10

Self-Reported Core Courses Grade Distribution of Participates



Descriptive Statistics Analysis of Survey Questions

Throughout the survey a 5-point Likert-type scale was used. For questions 1 to 13 which examined the "Usefulness of Smartphones for Schools in Classrooms", a mean score above 3.0 reported some level of agreement where a mean score below 3.0 reported some level of disagreement. For questions 14 to 19, "Usefulness of Smartphones for Schools During Remote Learning" in the same section, a 5-point Likert-type scale without a neutral response was used. A mean score above 3.0 reported some level of use most of time, and a mean score below 3.0 reported rarely being used. Table 4-19 shows the average mean scores and standard deviations reported for the Usefulness of Smartphones for School. For the questions whether smartphone use can help survey participants gets better grades in their subjects, understand subject material more, help classes be more interesting, help make

learning fun, and help read more books/articles in class, the average scores were higher than 3.60 indicating some form of agreement. Also, the highest average mean score of 3.98 indicated agreement on whether smartphone use allows survey participants to collaborate with their classmates outside of class. For the questions whether smartphone use can save time in class, motivate survey participants to participate in class, or cause survey participants to be more actively involved in class, the average scores were between 3.10 and 3.44 indicating students neither agreed nor disagreed.

Table 4-19

Mean Scores for Survey Questions 1 thru 13

Mean Scores for Questions 1 thru 13: (1=Strongly Disagree, 5=Strongly Agree)
Usefulness of Smartphones for School in Classrooms

Survey question		*n*	*M*	*SD*
1.	Smartphone use can help me get better grades in my subjects.	202	3.77	0.945
2.	Smartphone use can help me understand subject material more.	202	3.76	0.921
3.	Smartphone use makes completing my schoolwork more convenient.	202	3.64	0.968
4.	Smartphone use motivates me to explore subject topics on my own.	202	3.67	1.009
5.	Smartphone use can help with classroom discussions.	202	3.44	0.966
6.	Smartphone use can save time in class.	202	3.32	1.046
7.	Smartphone use can help classes be more interesting.	202	3.71	0.977

8.	Smartphone use motivates me to participate in class.	202	3.10	1.084
9.	Smartphone use can make learning fun in class.	202	3.62	1.035
10.	Smartphone use can allow me to collaborate with others easily in class.	201	3.52	0.990
11.	I would be more actively involved in class if I can use my smartphone.	201	3.21	1.113
12.	Using my smartphone to access books/articles will help me read more in class.	202	3.73	1.055
13.	Smartphone use allows me to collaborate with others easily outside of class.	202	3.98	0.946

The results shows that high school students overall find smartphones useful in school during class. Smartphones can be used to make learning fun and more interesting. At the same time, students can use smartphones to access lesson materials and to collaborate with their classmates potentially resulting in better grades for their classes. Students are using their smartphones to complete assignment and to look-up material online. However, students do not feel that smartphones motivate them to do well or to participate more in class. So, although smartphone is the preferred technology for use, smartphones are not a motivating factor for students' engagement and participation in classes.

As shown on Table 4-20 below, participants indicated that during remote learning their smartphone was used most of the time to check their email for information about school, to search for more information online to complete assignments, and to stay connected to their classes with average scores of 3.88, 3.78, and 3.66, respectively. On average some of the time, with scores of 3.32, 3.27, and 3.03, respectively, participants indicated that they

used online apps on their smartphones to help with assignments, to complete assignments during remote learning, and to attend their classes during remote learning.

Table 4-20

Mean Scores for Survey Questions 14 thru 19

Mean Scores for Questions 14 to 19: (1=Never, 5=All the time) Usefulness of Smartphones for School during Remote Learning			
Survey question	*n*	*M*	*SD*
14. I use online apps on my smartphone to help me with my assignments.	200	3.32	0.959
15. During remote learning, I used my smartphone to check my emails for information about school.	200	3.88	1.150
16. During remote learning, I used my smartphone to stay connected to my classes.	200	3.66	1.212
17. During remote learning, I used my smartphone to complete my assignments.	200	3.27	1.201
18. During remote learning, I used my smartphone to attend my classes.	200	3.03	1.301
19. During remote learning, I used my smartphone to search for more information online to complete my assignments.	201	3.78	1.037

Smartphones were very useful for most students during remote learning as the result of the COVID-19 pandemic. Not only were students able to connect with their schools and attend classes via their smartphones, smartphones were used to help students complete their assignments without the presence of their teachers. Oftentimes, students had to use online

applications and search for more information to complete class work. Students were using their smartphone technology as independent learners. Also, students mostly used their smartphones to stay connected and informed on what was going on at school.

For questions 20 to 29 which examined the participants "Beliefs and Understanding of Smartphone Policies" in school, a mean score above 3.0 reported some level of agreement where a mean score below 3.0 reported some level of disagreement. For questions 30 and 31 which examine participants' "Experience for Using Smartphones in School" in the same section, a 5-point Likert-type scale without a neutral response was used. A mean score above 3.0 reported some level of experience most of time, and a mean score below 3.0 reported rare experience. As shown on Table 4-21 below, participants agree that students should not be getting in trouble for just using their smart phone, should be allowed to use smartphones in school, and that having their smartphones made them feel safer in school, with an average score above 3.69, 4.08, and 4.27 respectively. Participants neither agreed nor disagreed when asked if 'Smartphone use in school causes a lot of problems' with an average score of 3.07. Participants on average did not feel that their smartphone use was a distraction to other students, with an average score of 2.32. However, students neither agreed nor disagreed that smartphones are distractions for them or their teachers in class with average scores 2.60 and 2.90. Participants indicated that they fully understand the smartphone use policy for their school with an average score of 3.70.

Table 4-21

Mean Scores for Survey Questions 20 thru 29:

Mean Scores for Questions 20 to 29: (1=Strongly Disagree, 5=Strongly Agree) Beliefs and Understanding of Smartphone Policies in School				
		n	*M*	*SD*
20.	Students should NOT be getting in trouble for just using their smartphone in school.	197	3.69	1.001
21.	Smartphone use in school causes a lot of problems.	195	3.07	0.942
22.	Smartphone use in school makes me feel unsafe.	196	1.98	1.116
23.	I feel safer having my smartphone with me in school.	197	4.27	0.831
24.	Smartphone use interferes with my abilities to concentrate in class.	196	2.90	0.928
25.	Having my smartphone in class is a distraction for me.	196	2.60	1.031
26.	Having my smartphone in class is a distraction to other students.	195	2.32	1.090
27.	Having my smartphone in class is a distraction to my teachers.	196	2.90	1.177
28.	I fully understand the smartphone use policy for my school.	196	3.70	0.914
29.	I should be allowed to use my smartphone in school.	197	4.08	0.958

In addition, with an average score of 2.36, participants indicated that they rarely get in trouble for using their smartphones in class. However, participants some of the times see

other students getting in trouble for using their smartphone in class, with an average score of 3.19. (See Table 4-22 below).

Table 4-22

Mean Scores for Survey Questions 30 and 31

Mean Scores for Questions 30 and 31: (1=Never, 5=All the time) Beliefs and Understanding of Smartphone Policies in School				
		n	*M*	*SD*
30.	How often do you get in trouble for using your smartphone in class?	194	2.36	1.083
31.	How often do you see other students getting in trouble for using their smartphone in class?	195	3.19	1.035

At times, mobile phone policies in school are ignored by students or set aside by teachers because not all students are getting in trouble for using their smartphones in school. Students have an overall belief that they should not be getting in trouble for using their smartphones in school. Students do not believe that smartphones are a distraction to them, their peers, and their teachers in school despite being on their smartphones constantly. By having their smartphones with them all the time in school, students feel safer.

For questions 32 to 43 which examined whether "Smartphones for Students Enables Connections", a mean score above 3.0 indicates some level of agreement whereas a mean score below 3.0 indicates some level of disagreement. For questions 44 to 48, "Usefulness of Smartphone Use", a 5-point Likert-type scale with a neutral response of Not Sure was used. A mean score above 3.0 reported some level of usefulness, and a mean score below 3.0

reported little to no usefulness. When participants considered how they use the smartphones to connect with other students, to society, their families, and their communities, participants indicated that they agree that smartphones make them feel more connected to other students with mean scores between 3.50 to 3.87. Students neither agreed nor disagreed that smartphone use makes them feel more connected with teachers and school activities with a mean score of 2.94 and 3.39, respectively. Students indicated a rather neutral response on whether their teachers should plan more lessons to use smartphones in their teaching, with a mean score of 3.39. The highest mean score of 4.24 indicated that smartphone use makes participants feel more connected with entertainment (See Table 4-23 below).

Table 4-23

Mean Scores for Survey Questions 32 thru 43

Mean Scores for Questions 32 thru 43 (1=Strongly Disagree, 5=Strongly Agree) Smartphones for Student Enables Connections				
		n	*M*	*SD*
32.	Smartphone use makes me feel more connected to other students.	193	3.51	0.953
33.	Smartphone use makes me feel more connected with teachers.	193	2.94	1.042
34.	Smartphone use makes me feel more connected with school activities.	193	3.39	0.979
35.	Smartphone use makes me feel more connected with my family.	193	3.87	1.075
36.	Smartphone use makes me feel more connected with my community.	193	3.60	1.006

37.	Smartphone use makes me feel more connected with entertainment (i.e., games, movies, TV shows, music, etc.)	193	4.24	0.853
38.	My teachers should plan more to use smartphone in their teaching.	193	3.39	1.030
39.	Smartphone use connects me to society.	193	3.81	0.984
40.	Smartphone use connects my cultural identity to society.	193	3.50	1.011
41.	Smartphone use is a part of who I am.	191	3.14	1.181
42.	Smartphone use connects me to community resources.	193	3.65	0.912
43.	Smartphone use is essential to my life.	193	3.42	1.111

It is evident that students have not fully recognized their smartphones as technology to connect to school or school activities although they are constantly on their smartphones and use them for lesson assignments. Students consider the primary use of their smartphones to connect with their friends, family members, and their communities. This can be the result of several reasons such as ban mobile phone policies and rules that still exist in schools and classrooms; there is no widespread intentional lesson or curriculum planning which embed smartphone use in schools, and some students are still getting in trouble for using their smartphones. Additionally, students themselves are still contemplating whether teachers should make a concerted effort to use smartphones in their teaching.

When considering the degree of usefulness smartphones have for receiving notifications about class information, receiving messages about discussion questions a day before class, scheduling meetings with teachers, meeting with teachers, or receiving calendar

reminders of school's events, participants agree that smartphones are relatively useful, with mean scores ranging between 3.61 and 3.94 (See Table 4-24 below).

Table 4-24

Mean Scores for Survey Questions 44 thru 48

Mean Scores for Questions 44 thru 48 (1=Not Useful At All, 5=Very Useful) Connection Usefulness of Smartphones				
		n	*M*	*SD*
44.	How useful do you think receiving notifications on your smartphone about class information (i.e., assignments, grades, tests dates, etc.)?	186	3.93	1.035
45.	How useful do you think receiving messages on your smartphone about discussion questions a day before class?	187	3.68	1.109
46.	How useful do you think using your smartphone to schedule meetings with your teachers?	187	3.77	1.040
47.	How useful do you think using your smartphone to meet with your teachers?	187	3.61	1.053
48.	How useful do you think receiving calendar reminders on your smartphone of school events?	189	3.94	1.029

As with social media activities, students find it very beneficial to use their smartphones to receive notifications for school assignments, test dates, and school activities. Students believe that teachers can use calendar applications to notify them of student-teacher

meetings and to remind them of due dates and school activities. Also, students are interested in receiving messages about upcoming assignments, discussion questions, and lesson plans to be better prepared before arriving to school the next day.

For questions 49 to 54, which examine participants' "Experience for Smartphone Use" in school, a 5-point Likert-type scale without a neutral response was used. A mean score above 3.0 reported some level of experience most of time, and a mean score below 3.0 reported rare experiences. As shown on Table 4-25, participants indicated that most of the time they use social media applications daily in school with a mean score of 3.88. On the other hand, participants indicated that teachers rarely encourage smartphone use for learning in class with a mean score of 2.41. Participants indicated that if allowed by their teachers, they would use their smartphone most of time to research topics on the Internet and access online audio and videos to learn more about the lesson content, with average scores of 3.78 and 3.65, respectively.

Table 4-25

Mean Scores for Questions 49 thru 54

Mean Scores for Questions 49 thru 54: (1=Never, 5=All the time) *Smartphone Use in School Experiences*				
		n	*M*	*SD*
49.	How often do you use social media applications daily (i.e., Facebook, Instagram, SnapChat, Twitter, LinkedIn, etc.)?	187	3.88	0.984
50.	How often do your teachers encourage smartphone use for learning in class?	186	2.41	1.058

51.	How often do your teachers encourage smartphone use for learning outside of class?	187	2.80	1.132
52.	If allowed by your teacher, how often would you use your smartphone to take notes in class?	187	3.30	1.062
53.	If allowed by your teacher, how often would you use your smartphone to research subject topics on the Internet?	187	3.78	0.980
54.	If allowed by your teacher, how often would you use your smartphone to access online audio/video recordings to learn more about your class content?	187	3.65	0.979

Students are ready to use their smartphones for school to enhance teaching and learning. If teachers are more intentional with using smartphone technology in classes and allow students on a regular bases to utilize smartphones to connect to online applications and resources, students will use their smartphone technology for more school-related purposes. From taking notes to doing independent research to accessing multimedia applications to learning more about their lesson concepts, students can spend more time on task while on their smartphones in school instead of off task with social media activity. However, students are mostly discouraged from using their smartphones at all for any purpose while in school. These mid-level scores are an indication of the lukewarm, half-in and half-out, attitudes of smartphone us in schools. A full-fledged intentional embrace of smartphone use could alleviate uncertainties around smartphone use in school and enhance students' learning experiences.

Validity and Reliability for Survey Items

Validity

The validity of the survey components was tested through a face-validity and content-validity test. Prior to administering the survey, I asked several colleagues within my graduate program whether the survey questions were relevant to my research questions and high school students and whether the methodology is useful for measuring the variables in each of the survey categories. In addition, prior to administering the survey, I asked ten randomly selected ninth grade students to review the survey instruments and provide feedback on the questions format and vocabulary, and whether other questions related to smartphone use should be added. Based on my colleagues' and the students' feedback, the vocabulary and wording for 25 questions were adjusted, several questions were rearranged, two questions were removed, and three questions were added to the survey instrument.

Reliability

For subcategory variables that consisted of multiple survey questions, Cronbach's Alpha testing was conducted to measure the internal consistency and reliability of each subcategory variable within the survey. These subcategory variables, their scaled mean scores, standard deviation, and Alpha results are listed below in Table 4-26.

Table 4-26

Cronbach's Alpha Results for Study Variables

Subcategory variables	Survey question #	*M*	*SD*	*Cronbach's* α
Usefulness of Smartphones for School				
Usefulness Classroom	#1 to #13	46.47	9.204	0.915
Usefulness Remote	#15 to #19	17.62	4.705	0.855
Beliefs and Understanding of Smartphone Use				
Beliefs Safe	#22 to #23	8.29	1.598	0.483
Beliefs Distraction	#24 to #27	10.70	3.171	0.740
Smartphones for Students Enable Connections				
Connections Me	#32 to #37	21.56	4.303	0.821
Connections Society	#39 to #43	17.56	4.044	0.836
Connections Classroom	#44 to #48	18.97	4.199	0.858
Teacher Encouraged	#50 to #51	5.20	1.959	0.758
Teacher Allowed	#52 to #54	10.74	2.353	0.671

Both defined variables in the Usefulness of Smartphones for School subcategory had an alpha score greater than 0.700, indicating a good level of scale reliability for the questions on smartphones being useful in the classroom and during remote learning. Questions 22 (reverse coded) and 23 comprising the Beliefs Safe variable within the Beliefs of Smartphone Use subcategory had an alpha school of 0.483, which is significantly less than 0.700. The responses for the Beliefs Safe variable were determined to be unreliable taking together. Since this construct only contained two survey questions, the descriptive statistics of each question were reviewed separately. However, the variable Beliefs Distractions within the same subcategory had an alpha score greater than 0.700.

All the defined variables except one in the Smartphone Enables Connections category had a Cronbach's Alpha score greater than 0.700, indicating a good level of scale reliability for the questions on how connected participants are to their smartphones.

Perceptions of Smartphone Technology

Usefulness of Smartphone Technology

Research Question 1. The first research question examines whether students believe smartphone technology is useful in school or during remote learning. With a mean score of 3.575 (variance = 0.061), participants on average agree that smartphones can be useful in the classroom during school. See Table 4-27 below. In addition, with a mean score of 3.523 (variance = 0.132), participants indicated that their smartphones were used most of the time for school during remote learning.

Table 4-27

Descriptive Statistics and Inter-Item Correlations for Study Variables

Variables	*N*	*M*	*Min*	*Max*	*Range*	*Max/Min*	*Var*
Usefulness classroom	13	3.575	3.105	3.975	0.870	1.280	0.061
Inter-Item correlations	13	0.452	0.225	0.698	0.473	3.101	0.009
Usefulness remote learning	5	3.523	3.025	3.880	0.855	1.283	0.132
Inter-Item correlations	5	0.543	0.425	0.706	0.281	1.661	0.007

Students are using their smartphone technology to help them get better grades in their classes and to understand the content material better. Instead of waiting their turn for help from teachers, students are turning to their smartphones to use online applications to help them complete assignments. Students are making use of their primary technology asset to help them learn in school. Also, students find subjects more interesting and are more motivated to engage in text when using their smartphone in classes. Thus, increasing engagement and academic participation in classes. During remote learning, students primarily used their smartphones as the preferred technology to attend classes, complete assignments, and to check emails for information regarding school. Being that their smartphones are on them all the time, smartphone technology are easily being access by student to use for multiple reasons for their learning.

Smartphone Use Policy

Research Question 2. In terms of participants beliefs related to safety, distraction and use policy in school, participants agree that having their smartphones makes them feel safer in school and that they understand what the smartphone use policy is for school, with means scores of 4.27 (variance = 0.690) and 3.700 (variance = 0.835), respectively. However, with a mean score of 2.676 (variance = 0.076) participants neither agreed nor disagreed on whether smartphone use in school is a distraction. See Table 4-28 below.

Table 4-28

Descriptive Statistics and Inter-Item Correlations for Study Variables

Variables	*N*	*M*	*Min*	*Max*	*Range*	*Max/Min*	*Var*
Beliefs safe (#23)	1	4.270	2.000	5.000	3.000	2.500	0.690
Inter-Item correlations	1	--	--	--	--	--	--
Beliefs distractions	4	2.676	2.231	2.902	0.580	1.250	0.076
Inter-Item correlations	4	0.418	0.278	0.498	0.221	1.794	0.006
Beliefs policy (#28)	1	3.700	1.000	5.000	4.000	4.000	0.835
Inter-Item correlations	1	--	--	--	--	--	--

Regardless of the mobile phone use policies in school, the overall belief by students is that they should not be getting in trouble for using their smartphones in school. Students want to be able to have access to their smartphone and use their smartphone anytime or anywhere, regardless of whether they are in school or not. And because smartphones have become more of a personal assistance device, students are feeling safer in school having their smartphones with them all the time, just in case of emergency situations. This is quite evident because even with smartphone ban policies in classes that students are aware of, students have their smartphone with them and use them anyway.

Students were a little reluctant to indicate whether smartphones were a distraction in school or not. On one hand, students want to have their phone with them all the time and to be able to use them when they want to. On the other hand, students know that there are a few

students who may cause distractions in classes or school drama with inappropriate use of their smartphones with social media activity or sounds from music, games, or notifications. With those situations being considered, students do not believe ban smartphone policies is warranted.

Connectiveness of Smartphone Technology

Research Question 3. In terms of how using smartphones enables connections with themselves and to society, the participants agree with mean scores of 3.593 (variance = 0.194) and 3.512 (variance = 0.067), respectively. See Table 4-29 below. Similarly, the participants agree that smartphone connections with classroom in school is useful with a mean score of 3.794 (variance = 0.021). When the participants were asked how often their teacher encouraged them to use their smartphone for learning, the participants indicated some of the time with a mean score of 2.599 (variance = 0.069). When asked if they were allowed by their teachers to use their smartphones in class for notes, research or to access audio/video lesson content, the participants indicated they would most of the time, with a mean score of 3.579 (variance = 0.060).

Table 4-29

Descriptive Statistics and Inter-Item Correlations for Study Variables

Variables	*N*	*M*	*Min*	*Max*	*Range*	*Max/Min*	*Var*
Connections me	6	3.593	2.943	4.244	1.301	1.442	0.194
Inter-Item Correlations	6	0.429	0.080	0.631	0.511	7.869	0.026
Connections society	5	3.512	3.141	3.827	0.686	1.218	0.067

Inter-Item correlations	5	0.510	0.392	0.631	0.239	1.609	0.006
Connections classroom	5	3.794	3.618	3.952	0.333	1.092	0.021
Inter-Item correlations	5	0.548	0.446	0.646	0.200	1.448	0.003
Teacher encouraged	2	2.599	2.414	2.785	0.371	1.154	0.069
Inter-Item correlations	2	0.612	0.612	0.612	0.000	1.000	0.000
Teacher allowed	3	3.579	3.306	3.780	0.473	1.143	0.060
Inter-Item correlations	3	0.406	0.326	0.474	0.149	1.457	0.005

Although teachers are not encouraging students to use their smartphone technology in school and are not making intentional plans to incorporate smartphone within lessons, students still feel the need to be connected with their peers, their families, and social activities via their smartphone. Students are constantly connected to social media and entertainment streaming applications for music, games, shows, and movies; mostly to pass time, reduce anxiety, or get through the day. Students want to be able to contact their family members during anytime of the day. Furthermore, with the prevalent use of smartphone technology, parents and guardians of students except to be able to connect with their child at any time while in school, without going through the main office.

Students could not make up their minds on whether they needed their smartphone to be connected with their teachers or school. This could be a result of ban mobile phone policies and the constant nagging by teachers for students to put away their smartphone. Students did indicate that, if allowed by teachers, they would use their smartphones more in

school. Which means that there are some students who are trying to follow the ban mobile phone policies in school even though it does not make sense for this generation.

Factors Influencing Perceptions on Usefulness of Smartphone Technology

Participants demographics of disabilities, race/ethnicity, gender, and grade level were used to determine if statistical significance exists for the subcategory variables within the survey. A t-test was conducted to compare the means of students who self-identified as having a disability and those without. An ANOVA test was completed to compare means for the three race/ethnicity groups, the three gender identifications, and the four grade levels of the subcategory variables. Also, a chi square test was conducted to further analyze the subcategories for the participants demographics of disabilities, race/ethnicities, gender, and grade levels.

Disability Effects on Usefulness of Smartphone Technology

T-tests were completed to analyze the mean scores of students who self-identified as having a physical and/or a learning disability as compared to students who do not for the Usefulness variables. The results of these T-tests are summarized below in Table 4-30. There was no significant difference in both variables for Usefulness of smartphone use. The p-values were greater than 0.05, calculated at 0.194 and 0.404.

Table 4-30

Summary of T-Test for Students with or without Disabilities and the Usefulness Variables

Variables	Student without Disabilities			Students with Disabilities					
	M	*SD*	*N*	*M*	*SD*	*N*	*df*	*t*	*p*

Usefulness classroom	45.747	9.086	153	49.600	8.579	10	161	-1.303	0.194
Usefulness remote	21.028	5.581	153	22.560	6.140	10	161	-0.836	0.404

*p< 0.05 **p< 0.01 ***p<0.001

A chi square analysis was conducted to see if there was significant difference between students with disabilities versus students without disabilities regarding the usefulness of smartphones in the classroom. The crosstab results of the chi square test with frequency are shown above in Table 4-31. The chi square test showed that there is no significant difference (X^2=3.151, p>0.05).

Table 4-31

Summary of Chi Square for Usefulness in the Classroom for Students with Disabilities

Usefulness in the Classroom for Students with Disabilities								
Independent Variable	**1**	**2**	**3**	**4**	**5**	**Total**	X^2	*p*
No Disability	0	10	59	74	10	153	3.151	0.369
% Likert Score	0.0 %	6.5%	38.6%	48.4%	6.5%	100.0%		
Disability	0	0	3	5	2	10		
% Likert Score	0.0%	0.0%	30.0%	50.0%	20.0%	100.0%		
Total	0	10	62	79	12	163		
% Likert Score	0.0%	6.1%	38.0%	48.5%	7.4%	100.0%		

*p< 0.05 **p< 0.01 ***p<0.001

Table 4-32

Summary of Chi Square for Usefulness During Remote Learning for Students with Disabilities

Usefulness During Remote Learning for Students with Disabilities								
Independent Variable	**1**	**2**	**3**	**4**	**5**	**Total**	X^2	***p***
No Disability	3	10	23	47	70	153	2.161	0.706
% Likert Score	2.0 %	6.5%	15.0%	30.7%	45.8%	100.0%		
Disability	0	1	0	4	5	10		
% Likert Score	0.0%	10.0%	0.0%	40.0%	50.0%	100.0%		
Total	3	11	23	51	75	163		
% Likert Score	1.8%	6.7%	14.1%	31.3%	46.0%	100.0%		

*p< 0.05 **p< 0.01 ***p<0.001

A chi square analysis was conducted to see if there was significant difference between students with disabilities versus students without disabilities regarding the usefulness of smartphones during remote learning. The crosstab results of the chi square test with frequency are shown above in Table 4.32. The chi square test showed that there is no significant difference (X^2=2.161, p>0.05). Students with disabilities are using their smartphone technology at the same rate as students without disabilities. Some students with disabilities are actually using specific features of smartphone technology to accommodate their disabilities, such as text-to-speech, captions, or videos with pictures to bring context to lessons. The personalization features of smartphones are beneficial and appreciated by students with disabilities just as much as for student without disabilities which make smartphone technology a natural choice both inside and outside of school.

Race Effects on Usefulness of Smartphone Technology

ANOVA tests were completed to compare means for the three race/ethnicity groups and the Usefulness variables. The results are summarized in Table 4-33 below, which show that there was significant difference in the Usefulness Remote variable. The p-value was greater than 0.05 for the Usefulness calculated at 0.752. A p-value less than 0.05 is typically considered to be statistically significant, in which case the null hypothesis should be rejected. A p-value greater than 0.05 means that deviation from the null hypothesis is not statistically significant, and the null hypothesis is not rejected. For the Usefulness Remote variable, the p-value was 0.006 (<0.05) which indicate statistically significance between race/ethnicity of students. A Tukey Post Hoc Test was conducted to further analyze the significance between Usefulness Remote variable and the participants race/ethnicity demographics.

Table 4-33

Summary of ANOVA Results for Race Ethnicity and Mean Score of Usefulness Variables

Variables	**Race/Ethnicity**	*N*	*M*	*SD*	*F ratio*	*p*
Usefulness	AsianPacific/Mixed/NotListed	39	46.282	10.099	0.286	0.752
classroom	Black/African-American	77	45.286	8.508		
	Hispanic/LatinX	53	46.440	9.987		
Usefulness	AsianPacific/Mixed/NotListed	39	20.892	5.640	5.326	0.006*
remote	Black/African-American	77	20.073	5.604		
	Hispanic/LatinX	53	23.140	4.584		

*p< 0.05 **p< 0.01 ***p<0.001

The post hoc test results in Table 4-34 below show that the statistical significance within Usefulness Remote lies between the mean scores of Black/African-American and Hispanic/LatinX participants, 20.073 and 23.140 respectively. When comparing Black/African-American to Hispanic/LatinX students, Black/African-American students on average used their smartphones significantly less during remote learning to connect to school than Hispanic/LatinX students. The active attendance and participation in school during remote learning for Black students were consistently lower than Hispanic/LatinX students while on videoconference for classes. Black students seem to have more challenges than Hispanic/LatinX students in dealing with or knowing how to compensate for family distractions during remote schooling. In addition, more Black students experienced being home alone or in their rooms alone during remote learning schooling. Possibly students were mentally checking out of school whether on their smartphone or Chromebooks altogether.

Table 4-34

Summary of Tukey Post Hoc Test for Usefulness Remote and Race/Ethnicity

Race/Ethnicity	Race/Ethnicity	*M Dif*	*SE*	*p*
AsianPacific/Mixed/ Not Listed	Black/African-American	0.820	1.044	0.713
	Hispanic/LatinX	-2.247	1.121	0.114
Black/African-American	AsianPacific/Mixed/ Not Listed	-.0820	1.044	0.713
	Hispanic/LatinX	-3.067	0.948	0.004*
Hispanic/LatinX	AsianPacific/Mixed/ Not Listed	2.247	1.121	0.114
	Black/African-American	3.067	0.948	0.004*

*p< 0.05 **p< 0.01 ***p<0.001

The next chi square analysis was conducted to see if there were significance difference between students' race/ethnicity for the usefulness of smartphones in the classroom. The crosstab results of the chi square test with frequency are shown in Table 4-35 below. The chi square test showed that there is no significant difference (X^2=3.207, p>0.05) between the race/ethnicity of students.

Table 4-35

Summary of Chi Square for Usefulness in the Classroom for Race/Ethnicity

Usefulness in the Classroom for Race/Ethnicity								
Independent Variable	**1**	**2**	**3**	**4**	**5**	**Total**	X^2	*p*
AsianPac/Mixed/Not	0	2	15	18	4	39	3.207	0.782
% Likert Score	0.0 %	5.1%	38.5%	46.2%	10.3%	100.0%		
Black/African Amer	0	5	32	37	3	77		
% Likert Score	0.0%	6.5%	41.6%	48.1%	3.9%	100.0%		
Hispanic/LatinX	0	4	19	24	6	53		
% Likert Score	0.0%	7.5%	35.8%	45.3%	11.3%	100.0%		
Total	0	11	66	79	13	169		
% Likert Score	0.0%	6.5%	39.1%	46.7%	7.7%	100.0%		

*p< 0.05 **p< 0.01 ***p<0.001

The next chi square analysis was conducted to see if there were significance difference between students' race/ethnicity for the usefulness of smartphones during remote learning. The crosstab results of the chi square test with frequency are shown in Table 4-36 below. The chi square test showed that there is no significant difference (X^2=12.641, p>0.05) between the race/ethnicity of students.

Table 4-36

Summary of Chi Square for Usefulness During Remote Learning for Race/Ethnicity

Usefulness During Remote Learning for Race/Ethnicity								
Independent Variable	**1**	**2**	**3**	**4**	**5**	**Total**	X^2	***p***
AsianPac/Mixed/Not	1	1	8	12	17	39	12.641	0.125
% Likert Score	2.6 %	2.6%	20.5%	30.8%	43.6%	100.0%		
Black/African Amer	2	7	14	23	31	77		
% Likert Score	2.6%	9.1%	18.2%	29.9%	40.3%	100.0%		
Hispanic/LatinX	0	0	4	21	28	53		
% Likert Score	0.0%	0.0%	7.5%	39.6%	52.8%	100.0%		
Total	3	8	26	56	76	169		
% Likert Score	1.8%	4.7%	15.4%	33.1%	45.0%	100.0%		

*p< 0.05 **p< 0.01 ***p<0.001

Gender Effects on Usefulness of Smartphone Technology

An ANOVA test was completed to compare means for the three gender identifications and the subcategory variables. The results are summarized in Table 4-37 below. There was no significant difference in the Usefulness Classroom variable (with a p-value calculated at 0.236), however for the Usefulness Remote variable, the p-value was 0.001 (<0.05), indicating statistical significance between gender identifications of students. A Tukey Post Hoc Test was conducted to further analyze the significance between Usefulness Remote variable with the participants gender identification demographic.

Table 4-37

Summary of ANOVA Results for Gender and Mean Score of Usefulness Variables

Variable	Gender	N	M	SD	F ratio	p
Usefulness classroom	Male	85	47.200	8.858	1.454	0.236
	Female	88	45.004	9.390		
	Non-Binary/Not Listed	2	42.000	4.243		
Usefulness remote	Male	85	22.744	4.828	7.681	0.001***
	Female	88	19.827	5.730		
	Non-Binary/Not Listed	2	15.600	3.394		

*p< 0.05 **p< 0.01 ***p<0.001

The post hoc test results in Table 4-38 below show that the statistical significance within Usefulness Remote variable lies between the means of Female and Male participants. When comparing female to male students, male students on average used their smartphones significantly less during remote learning to connect to school than female students, with average mean scores of 19.827 and 22.744, respectively.

Table 4-38

Summary of Tukey Post Hoc Test for Usefulness Remote with Gender Identity Demographic

Variable	Gender	Gender	M Dif	SE	p
Usefulness remote	Female	Male	2.916	0.806	0.001*
		NonBinary/Not Listed	7.144	3.790	0.146
	Male	Female	-2.916	0.806	0.001*
		NonBinary/Not Listed	4.227	3.788	0.506
	NonBinary/Not Listed	Female	-7.144	3.790	0.146
		Male	-4.227	3.788	0.506

*p< 0.05 **p< 0.01 ***p<0.001

A chi square analysis was conducted to see if there was significance difference between students' gender classifications for the usefulness of smartphones in the classroom. The crosstab results of the chi square test with frequency are shown below in Table 4-39. The chi square test showed that there is no significant difference between Male, Female and Non-Binary students for smartphone usefulness in the classroom (X^2=10.131, p>0.05).

Table 4-39

Summary of Chi Square for Usefulness in the Classroom for Gender

Usefulness in the Classroom for Gender								
Independent Variable	**1**	**2**	**3**	**4**	**5**	**Total**	X^2	***p***
Female	0	5	25	49	6	85	10.131	0.119
% Likert Score	0.0 %	5.9%	29.4%	57.6%	7.1%	100.0%		
Male	0	5	42	34	7	88		
% Likert Score	0.0%	5.7%	47.7%	38.6%	8.0%	100.0%		
Non-Binary/Not List	0	0	2	0	0	2		
% Likert Score	0.0%	0.0%	100.0%	0.0%	0.0%	100.0%		
Total	0	10	69	83	13	175		
% Likert Score	0.0%	5.7%	39.4%	47.4%	7.4%	100.0%		

*p< 0.05 **p< 0.01 ***p<0.001

A chi square analysis was conducted to see if there was significance difference between students' gender classifications for the usefulness of smartphones during remote learning. The crosstab results of the chi square test with frequency are shown below in Table 4-40. The chi square test showed that there is significant difference between Male, Female and Non-Binary students for smartphone usefulness during remote learning (X^2=16.798, p<0.05). Outside of family distractions during remote learning, students were using their smartphone phones to socialize with their friends via text and social media. In addition,

more male students were spending more time on gaming applications with their peers during remote learning school as well. This very well may be the confounding factor could explain while less male students found their smartphones less useful during remote learning. Gaming on a smartphone requires more focused time than just checking social media post periodically.

Table 4-40

Summary of Chi Square for Usefulness During Remote Learning for Gender

Usefulness During Remote Learning for Gender								
Independent Variable	**1**	**2**	**3**	**4**	**5**	**Total**	X^2	***p***
Female	0	4	8	23	50	85	16.798	0.032
% Likert Score	0.0 %	4.7%	9.4%	27.1%	58.8%	100.0%		
Male	3	6	16	34	29	88		
% Likert Score	3.4%	6.8%	18.2%	38.6%	33.0%	100.0%		
Non-Binary/Not List	0	0	1	1	0	2		
% Likert Score	0.0%	0.0%	50.0%	50.0%	0.0%	100.0%		
Total	3	10	25	58	79	175		
% Likert Score	1.7%	5.7%	14.3%	33.1%	45.1%	100.0%		

*p< 0.05 **p< 0.01 ***p<0.001

Grade-Level Effects on Usefulness of Smartphone Technology

An ANOVA test was completed to compare means for the participants grade level and the subcategory variables. The results are summarized in Table 4-41 below. There was no significant difference in both category variables. The p-value was greater than 0.05, calculated at 0.642 to 0.107. A p-value greater than 0.05 means that deviation from the null hypothesis is not statistically significant, and the null hypothesis is not rejected.

Table 4-41

Summary of ANOVA Results for Grade Level and Mean Score of Usefulness Variables

Variable	Grade Level	*N*	*M*	*SD*	*F ratio*	*p*
Usefulness	9th Grade	41	46.268	7.029	0.561	0.642
classroom	10th Grade	72	46.250	10.668		
	11th Grade	24	46.472	7.132		
	12th Grade	37	44.081	9.567		
Usefulness	9th Grade	41	19.493	5.595	2.064	0.107
remote	10th Grade	72	21.133	5.908		
	11th Grade	24	22.800	4.748		
	12th Grade	37	21.600	4.767		

*p< 0.05 **p< 0.01 ***p<0.001

The next chi square analysis was conducted to see if there were significance difference between students' grade levels for the usefulness of smartphones in the classroom. The crosstab results of the chi square test with frequency are shown in Table 4-42 below. The chi square test showed that there is no significant difference (X^2=9.444, p>0.05) between the grade levels of students.

Table 4-42

Summary of Chi Square for Usefulness in the Classroom for Grade Levels

Usefulness in the Classroom for Grade Levels								
Independent Variable	**1**	**2**	**3**	**4**	**5**	**Total**	X^2	***p***
9th Grade	0	1	18	21	1	41	9.444	0.397
% Likert Score	0.0 %	2.4%	43.9%	51.2%	2.4%	100.0%		
10th Grade	0	7	24	33	8	72		
% Likert Score	0.0%	9.7%	33.3%	45.8%	11.1%	100.0%		
11th Grade	0	0	10	13	1	24		

% Likert Score	0.0%	0.0%	41.7%	54.2%	4.2%	100.0%
12th Grade	0	3	17	14	3	37
% Likert Score	0.0%	8.1%	45.9%	37.8%	8.1%	100.0%
Total	0	11	69	81	13	174
% Likert Score	0.0%	6.3%	39.7%	46.6%	7.5%	100.0%

*p< 0.05 **p< 0.01 ***p<0.001

The next chi square analysis was conducted to see if there were significance difference between students' grade levels for the usefulness of smartphones during remote learning. The crosstab results of the chi square test with frequency are shown in Table 4-43 below. The chi square test showed that there is no significant difference (X^2=13.501, p>0.05) between the grade levels of students. Today's students of all ages are a part of the digital generation. Students at every grade-level are founding ways to use their smartphones for educational purpose and were using them during remote learning for school as well. Students' smartphone use experiences and applications within grade-levels are similar, so their attitudes about the usefulness of smartphones will tend to be similar as well.

Table 4-43

Summary of Chi Square for Usefulness During Remote Learning for Grade Levels

Usefulness During Remote Learning for Grade Levels								
Independent Variable	**1**	**2**	**3**	**4**	**5**	**Total**	***X²***	***p***
9th Grade	0	5	10	11	15	41	13.501	0.334
% Likert Score	0.0 %	12.2%	24.4%	26.8%	36.6%	100.0%		
10th Grade	2	4	11	23	32	72		
% Likert Score	2.8%	5.6%	15.3%	31.9%	44.4%	100.0%		
11th Grade	0	0	3	9	12	24		
% Likert Score	0.0%	0.0%	12.5%	37.5%	50.0%	100.0%		
12th Grade	1	0	4	15	17	37		
% Likert Score	2.7%	0.0%	10.8%	40.5%	45.9%	100.0%		
Total	3	9	28	58	76	174		
% Likert Score	1.7%	5.2%	16.1%	33.3%	43.7%	100.0%		

*p< 0.05 **p< 0.01 ***p<0.001

Figure 4-11 shows that over 50% of students across all demographics indicated that they agree or strongly agree that smartphones can be useful in the classroom except for males, 12th graders, and non-binary students. About 45% of male and 12th grade students felt smartphone can be useful in the classroom while no students who classify as non-binary gender did not. Again, for non-binary students, this could be due to the population size of participants was significantly lower than the other demographics. On the other hand, during remote learning due to COVID-19, the percentages of students across all demographics increased significantly indicating that for most of the time or all the time their smartphone was used to connect to school (See Figure 4-12). This aligns with the responses across demographics that students mostly use their smartphones to access the internet.

Figure 4-11

Percentage Agree or Strongly Agree for Usefulness in Classroom by Demographics

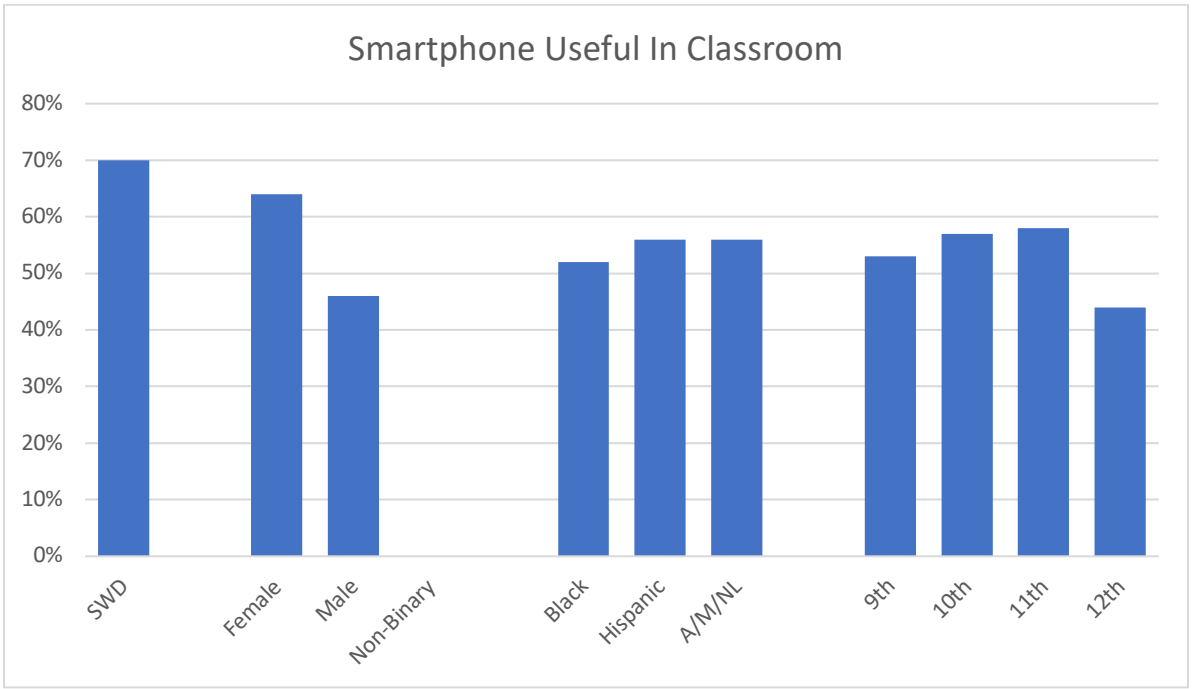
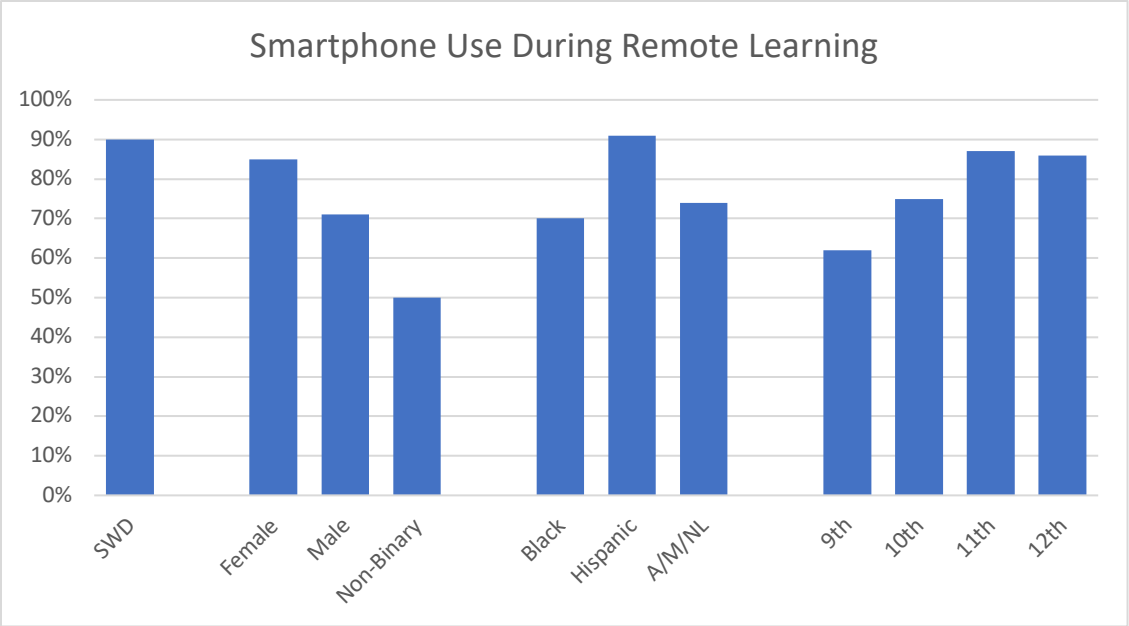


Figure 4-12

Percentage Most of the Time or All the Time for Smartphone Use During Remote Learning by Demographics



Factors Influencing Perceptions on Smartphone Use Policy

Disability Effects on Smartphone Use Policy

The t-test was completed to analyze the mean scores of students who self-identified as having a physical and/or a learning disability as compared to students who do not for the Smartphone Use Policy variables. The results of these t-tests are summarized below in Table 4-44. There was no significant difference in all smartphone use policy variables. In general, the p-values were greater than 0.05, ranging from 0.383 to 0.875.

Table 4-44

Summary of t-Test for Students with or without Disabilities and the Smartphone Use Policy Variables

Variables	Student without Disabilities			Students with Disabilities					
	M	*SD*	*N*	*M*	*SD*	*N*	*df*	*t*	*p*
Beliefs safe	4.260	0.836	152	4.500	0.707	10	160	-0.875	0.383
Beliefs distraction	10.566	3.121	152	10.400	4.477	10	160	0.158	0.875
Beliefs policy	3.660	0.907	152	3.900	0.876	10	160	-0.819	0.414

Table 4-45

Summary of Chi Square for Feel Safer with Smartphone for Students with Disabilities

Feel Safer with Smartphone for Students with Disabilities								
Independent Variable	**1**	**2**	**3**	**4**	**5**	**Total**	X^2	***p***
No Disability	0	4	26	48	74	152	0.798	0.850
% Likert Score	0.0 %	2.6%	17.1%	31.6%	75.1%	100.0%		
Disability	0	0	1	3	6	10		
% Likert Score	0.0%	0.0%	10.0%	30.0%	60.0%	100.0%		
Total	0	4	27	51	80	162		
% Likert Score	0.0%	2.5%	16.7%	31.5%	49.4%	100.0%		

*p< 0.05 **p< 0.01 ***p<0.001

A chi square analysis to conducted to see if there was significance difference between students with disabilities versus students without disabilities on whether students feel safer with their smartphones in school. The crosstab results of the chi square test with frequency are shown above in Table 4-45. The chi square test showed that there is no significant difference (X^2=0.798, p>0.05).

Table 4-46

Summary of Chi Square for Smartphone Distraction Belief for Students with Disabilities

Smartphone Distraction Belief for Students with Disabilities								
Independent Variable	**1**	**2**	**3**	**4**	**5**	**Total**	X^2	***p***
No Disability	11	45	74	19	3	152	3.617	0.460
% Likert Score	7.2 %	29.6%	48.7%	12.5%	2.0%	100.0%		
Disability	1	4	3	1	1	10		
% Likert Score	10.0%	40.0%	30.0%	10.0%	10.0%	100.0%		
Total	12	49	77	20	4	162		
% Likert Score	7.4%	30.2%	47.5%	12.3%	2.5%	100.0%		

*p< 0.05 **p< 0.01 ***p<0.001

A chi square analysis to conducted to see if there was significance difference between students with disabilities versus students without disabilities on whether students believe smartphones are a distraction in school. The crosstab results of the chi square test with frequency are shown above in Table 4-46. The chi square test showed that there is no significant difference (X^2=3.617, p>0.05).

Table 4-47

Summary of Chi Square for Smartphone Use Policy for Students with Disabilities

Smartphone Use Policy for Students with Disabilities								
Independent Variable	**1**	**2**	**3**	**4**	**5**	**Total**	X^2	***p***
No Disability	4	9	46	69	24	152	2.380	0.666
% Likert Score	2.6 %	5.9%	30.3%	45.4%	15.8%	100.0%		
Disability	0	1	1	6	2	10		
% Likert Score	10.0%	10.0%	10.0%	60.0%	20.0%	100.0%		
Total	4	10	47	75	26	162		
% Likert Score	2.5%	6.2%	29.0%	46.3%	16.0%	100.0%		

*p< 0.05 **p< 0.01 ***p<0.001

A chi square analysis to conducted to see if there was significance difference between students with disabilities versus students without disabilities on whether students understand the smartphone use policy in school. The crosstab results of the chi square test with frequency are shown above in Table 4-47. The chi square test showed that there is no significant difference (X^2=2.380, p>0.05). Just like students without disabilities, students with disabilities have gotten comfortable using their smartphones for different aspects of their lives. Smartphones are no longer seen as mere distraction to them but rather a trusted personal assistance device. Regardless of the smartphone use policies in school, students with disabilities need their smartphones to feel safer in school and to assist them with both social and educational tasks.

Race Effects on Smartphone Use Policy

ANOVA tests were completed to compare means for the three race/ethnicity groups and the Smartphone Use Policy variables. The results are summarized in Table 4-48 below. There was no significant difference in all variables. The p-value was greater than 0.05, ranging from 0.165 to 0.741.

Table 4-48

Summary of ANOVA Results for Race Ethnicity and Mean Score of Smartphone Use Policy Variables

Variables	**Race/Ethnicity**	*N*	*M*	*SD*	*F ratio*	*p*
Beliefs safe	AsianPacific/Mixed/NotListed	39	4.330	0.838	0.301	0.741
	Black/African-American	76	4.210	0.884		
	Hispanic/LatinX	53	4.280	0.769		
	AsianPacific/Mixed/NotListed	39	11.051	3.546	0.842	0.433

Beliefs	Black/African-American	76	10.671	2.796		
distractions	Hispanic/LatinX	53	10.208	3.248		
Beliefs policy	AsianPacific/Mixed/NotListed	39	3.950	0.686	1.822	0.165
	Black/African-American	76	3.620	0.909		
	Hispanic/LatinX	53	3.700	0.972		

*$p < 0.05$ **p< 0.01 ***p<0.001

The next chi square analysis was conducted to see if there were significance difference between students' race/ethnicity on whether students feel safer with their smartphones in school. The crosstab results of the chi square test with frequency are shown in Table 4-49 below. The chi square test showed that there is no significant difference (X^2=2.754, p>0.05) between the race/ethnicity of students.

Table 4-49

Summary of Chi Square for Feel Safer with Smartphone for Race/Ethnicity

Feel Safer with Smartphone for Race/Ethnicity								
Independent Variable	**1**	**2**	**3**	**4**	**5**	**Total**	X^2	*p*
AsianPac/Mixed/Not	0	1	6	11	21	39	2.754	0.839
% Likert Score	0.0 %	2.6%	15.4%	28.2%	53.8%	100.0%		
Black/African Amer	0	3	14	23	36	76		
% Likert Score	0.0%	3.9%	18.4%	30.3%	47.4%	100.0%		
Hispanic/LatinX	0	0	10	18	25	53		
% Likert Score	0.0%	0.0%	18.9%	34.0%	47.2%	100.0%		
Total	0	4	30	52	82	168		
% Likert Score	0.0%	2.4%	17.9%	31.0%	48.8%	100.0%		

*p< 0.05 **p< 0.01 ***p<0.001

The next chi square analysis was conducted to see if there were significance difference between students' race/ethnicity on whether students believe smartphones are a

distraction in school. The crosstab results of the chi square test with frequency are shown in Table 4.50 below. The chi square test showed that there is no significant difference (X^2=8.245, p>0.05) between the race/ethnicity of students.

Table 4-50

Summary of Chi Square for Smartphone Distraction Belief for Race/Ethnicity

Smartphone Distraction Belief for Race/Ethnicity								
Independent Variable	**1**	**2**	**3**	**4**	**5**	**Total**	X^2	*p*
AsianPac/Mixed/Not	2	15	14	6	2	39	8.245	0.410
% Likert Score	5.1 %	38.5%	35.9%	15.4%	5.1%	100.0%		
Black/African Amer	4	18	44	9	1	76		
% Likert Score	5.3%	23.7%	57.9%	11.8%	1.3%	100.0%		
Hispanic/LatinX	5	18	24	5	1	53		
% Likert Score	9.4%	34.0%	45.3%	9.4%	1.9%	100.0%		
Total	11	51	82	20	4	168		
% Likert Score	6.5%	30.4%	48.8%	11.9%	2.4%	100.0%		

*p< 0.05 **p< 0.01 ***p<0.001

The next chi square analysis was conducted to see if there were significance difference between students' race/ethnicity on whether students understand the smartphone use policy in school. The crosstab results of the chi square test with frequency are shown in Table 4-51 below. The chi square test showed that there is no significant difference (X^2=9.252, p>0.05) between the race/ethnicity of students.

Table 4-51

Summary of Chi Square for Smartphone Use Policy for Race/Ethnicity

Smartphone Use Policy for Race/Ethnicity								
Independent Variable	**1**	**2**	**3**	**4**	**5**	**Total**	X^2	*p*
AsianPac/Mixed/Not	0	1	7	24	7	39	9.252	0.322
% Likert Score	0.0 %	2.6%	17.9%	61.5%	17.9%	100.0%		
Black/African Amer	1	6	27	29	13	76		
% Likert Score	1.3%	7.9%	35.5%	38.2%	17.1%	100.0%		
Hispanic/LatinX	2	3	14	24	10	53		
% Likert Score	3.8%	5.7%	26.4%	45.3%	18.9%	100.0%		
Total	3	10	48	77	30	168		
% Likert Score	1.8%	6.0%	28.6%	45.8%	17.9%	100.0%		

*p< 0.05 **p< 0.01 ***p<0.001

Amongst all race/ethnical backgrounds, over 70% of the students feel that having their smartphones with them in school makes them feel safer. With the increase incidents in public schools and ethnophobia in communities, students in all racial backgrounds safety anxiety level are on the rise. So, all students are founding comfort with their smartphones knowing that they are able to connect with someone outside of school if something were to happen in school. Also, students no longer trust school or administrator to communicate to them in a timely manner if something was happening outside of school. Being aware of the mobile phone policies in school, students are still keeping their smartphone with them for just that reason. And, students are accepting any rare distractions caused by the use of smartphones in schools.

Gender Effects on Smartphone Use Policy

An ANOVA test was completed to compare means for the three gender identifications and the Smartphone Use Policy variables. The results are summarized in Table 4-52 below. There was no significant difference in all variables. The p-value was

greater than 0.05, ranging from 0.244 to 0.882. A p-value less than 0.05 is typically considered to be statistically significant, in which case the null hypothesis should be rejected. A p-value greater than 0.05 means that deviation from the null hypothesis is not statistically significant, and the null hypothesis is not rejected.

Table 4-52

Summary of ANOVA Results for Gender and Mean Score of Smartphone Use Policy Variables

Variable	Gender	N	M	SD	F ratio	p
Beliefs safe	Male	85	4.380	0.756	1.424	0.244
	Female	87	4.170	0.879		
	Non-Binary/Not Listed	2	4.00	1.414		
Beliefs distractions	Male	85	10.726	3.090	0.285	0.752
	Female	87	10.521	3.166		
	Non-Binary/Not Listed	2	12.000	0.000		
Beliefs policy	Male	85	3.730	0.918	0.126	0.882
	Female	87	3.680	0.842		
	Non-Binary/Not Listed	2	3.500	0.707		

*$p < 0.05$ **p< 0.01 ***p<0.001

A chi square analysis to conducted to see if there was significance difference between students' gender classifications on whether students feel safer with their smartphones in school. The crosstab results of the chi square test with frequency are shown below in Table 4-53. The chi square test showed that there is no significant difference between Male, Female and Non-Binary students (X^2=5.037, p>0.05).

Table 4-53

Summary of Chi Square for Feel Safer with Smartphone for Gender

Feel Safer with Smartphone for Gender								
Independent Variable	**1**	**2**	**3**	**4**	**5**	**Total**	X^2	***p***
Female	0	1	11	28	45	85	5.037	0.539
% Likert Score	0.0 %	1.2%	12.9%	32.9%	52.9%	100.0%		
Male	0	3	18	27	39	87		
% Likert Score	0.0%	3.4%	20.7%	31.0%	44.8%	100.0%		
Non-Binary/Not List	0	0	1	0	1	2		
% Likert Score	0.0%	0.0%	50.0%	0.0%	50.0%	100.0%		
Total	0	4	30	55	85	174		
% Likert Score	0.0%	2.3%	17.2%	31.6%	48.9%	100.0%		

*p< 0.05 **p< 0.01 ***p<0.001

A chi square analysis to conducted to see if there was significance difference between students' gender classifications on whether students believe smartphones are a distraction in school. The crosstab results of the chi square test with frequency are shown below in Table 4-54. The chi square test showed that there is no significant difference between Male, Female and Non-Binary students (X^2=6.663, p>0.05).

Table 4-54

Summary of Chi Square for Smartphone Distraction Belief for Gender

Smartphone Distraction Belief for Gender								
Independent Variable	**1**	**2**	**3**	**4**	**5**	**Total**	X^2	***p***
Female	3	29	38	13	2	85	6.663	0.573
% Likert Score	3.5 %	34.1%	44.7%	15.3%	2.4%	100.0%		
Male	8	24	45	8	2	87		
% Likert Score	9.2%	27.6%	51.7%	9.2%	2.3%	100.0%		
Non-Binary/Not List	0	0	2	0	0	2		
% Likert Score	0.0%	0.0%	100.0%	0.0%	0.0%	100.0%		
Total	11	53	85	21	4	174		

% Likert Score	6.3%	30.5%	48.9%	12.1%	2.3%	100.0%

*p< 0.05 **p< 0.01 ***p<0.001

A chi square analysis to conducted to see if there was significance difference between students' gender classifications on whether students understand the smartphone use policy in school. The crosstab results of the chi square test with frequency are shown below in Table 4-55. The chi square test showed that there is no significant difference between Male, Female and Non-Binary students (X^2=1.899, p>0.05).

Table 4-55

Summary of Chi Square for Smartphone Use Policy for Gender

Smartphone Use Policy for Gender								
Independent Variable	**1**	**2**	**3**	**4**	**5**	**Total**	X^2	*p*
Female	2	5	23	39	16	85	1.899	0.984
% Likert Score	2.4 %	5.9%	27.1%	45.9%	18.8%	100.0%		
Male	1	5	28	40	13	87		
% Likert Score	1.1%	5.7%	32.2%	46.0%	14.9%	100.0%		
Non-Binary/Not List	0	0	1	1	0	2		
% Likert Score	0.0%	0.0%	50.0%	50.0%	0.0%	100.0%		
Total	3	10	52	80	29	174		
% Likert Score	1.7%	5.7%	29.9%	46.0%	16.7%	100.0%		

*p< 0.05 **p< 0.01 ***p<0.001

Female and male students have similar beliefs for smartphone policies in school. Violent incidents, whether they are targeted or not, usually effects the entire school community no matter you gender identity. So, female students do not feel more or less safe than male students, or visa-versa. Everyone having their smartphone with them all the time makes them feel safer to the same degree. And, although female students tend to use social

media applications and male students tend to use mostly games during the day, neither group sees their smartphone as a distraction too much as the adults in school do.

Grade-Level Effects on Smartphone Use Policy

An ANOVA test was completed to compare means for the participants grade level and the Smartphone Use Policy. The results are summarized in Table 4-56 below. There was no significant difference in all category variables. The p-value was greater than 0.05, ranging from 0.431 to 0.557. A p-value greater than 0.05 means that deviation from the null hypothesis is not statistically significant, and the null hypothesis is not rejected.

Table 4-56

Summary of ANOVA Results for Grade Level and Mean Score of Smartphone Use Policy Variables

Variable	Grade Level	*N*	*M*	*SD*	*F ratio*	*p*
Beliefs safe	9th Grade	41	4.410	0.741	0.693	0.557
	10th Grade	72	4.310	0.833		
	11th Grade	24	4.130	0.900		
	12th Grade	36	4.250	0.770		
Beliefs distractions	9th Grade	41	10.390	2.914	0.774	0.510
	10th Grade	72	10.990	3.325		
	11th Grade	24	9.958	2.971		
	12th Grade	36	10.519	3.117		
Beliefs policy	9th Grade	41	3.730	0.923	0.923	0.431
	10th Grade	72	3.820	0.793		
	11th Grade	24	3.670	1.007		
	12th Grade	36	3.530	0.878		

*$p < 0.05$. **p< 0.01 ***p<0.001

The next chi square analysis was conducted to see if there were significance difference between students' grade levels on whether students feel safer with their smartphones in school. The crosstab results of the chi square test with frequency are shown in Table 4-57 below. The chi square test showed that there is no significant difference (X^2=4.440, p>0.05) between the grade levels of students.

Table 4-57

Summary of Chi Square for Feel Safer with Smartphone for Grade Levels

Feel Safer with Smartphone for Grade Levels								
Independent Variable	**1**	**2**	**3**	**4**	**5**	**Total**	***X²***	***p***
9th Grade	0	0	6	12	23	41	4.440	0.880
% Likert Score	0.0%	0.0%	14.6%	29.3%	56.1%	100.0%		
10th Grade	0	2	11	22	37	72		
% Likert Score	0.0%	2.8%	15.3%	30.6%	51.4%	100.0%		
11th Grade	0	1	5	8	10	24		
% Likert Score	0.0%	4.2%	20.8%	33.3%	41.7%	100.0%		
12th Grade	0	0	7	13	16	36		
% Likert Score	0.0%	0.0%	19.4%	36.1%	44.4%	100.0%		
Total	0	3	29	55	86	173		
% Likert Score	0.0%	1.7%	16.8%	31.8%	49.7%	100.0%		

*p< 0.05 **p< 0.01 ***p<0.001

The next chi square analysis was conducted to see if there were significance difference between students' grade levels on whether students believe smartphones are a distraction in school. The crosstab results of the chi square test with frequency are shown in Table 4-58 below. The chi square test showed that there is no significant difference (X^2=13.554, p>0.05) between the grade levels of students.

Table 4-58

Summary of Chi Square for Smartphone Distraction Belief for Grade Levels

Smartphone Distraction Belief for Grade Levels								
Independent Variable	**1**	**2**	**3**	**4**	**5**	**Total**	X^2	***p***
9th Grade	2	16	18	4	1	41	13.554	0.330
% Likert Score	4.9 %	39.0%	43.9%	9.8%	2.4%	100.0%		
10th Grade	3	21	36	9	3	72		
% Likert Score	4.2%	29.2%	50.0%	12.5%	4.2%	100.0%		
11th Grade	2	10	9	3	0	24		
% Likert Score	8.3%	41.7%	37.5%	12.5%	0.0%	100.0%		
12th Grade	5	5	22	4	0	36		
% Likert Score	13.9%	13.9%	61.1%	11.1%	0.0%	100.0%		
Total	12	52	85	20	4	173		
% Likert Score	6.9%	30.1%	49.1%	11.6%	2.3%	100.0%		

*p< 0.05 **p< 0.01 ***p<0.001

The next chi square analysis was conducted to see if there were significance difference between students' grade levels on whether students understand the smartphone use policy in school. The crosstab results of the chi square test with frequency are shown in Table 4.59 below. The chi square test showed that there is no significant difference (X^2=9.323, p>0.05) between the grade levels of students.

Table 4-59

Summary of Chi Square for Smartphone Use Policy for Grade Levels

Smartphone Use Policy for Grade Levels								
Independent Variable	**1**	**2**	**3**	**4**	**5**	**Total**	X^2	***p***
9th Grade	1	2	12	18	8	41	9.323	0.675
% Likert Score	2.4 %	4.9%	29.3%	43.9%	19.5%	100.0%		
10th Grade	1	2	18	39	12	72		
% Likert Score	1.4%	2.8%	25.0%	54.2%	16.7%	100.0%		
11th Grade	1	1	8	9	5	24		

% Likert Score	4.2%	4.2%	33.3%	37.5%	20.8%	100.0%
12th Grade	0	4	14	13	5	36
% Likert Score	0.0%	11.1%	38.9%	36.1%	13.9%	100.0%
Total	3	9	52	79	30	173
% Likert Score	1.7%	5.2%	30.1%	45.7%	17.3%	100.0%

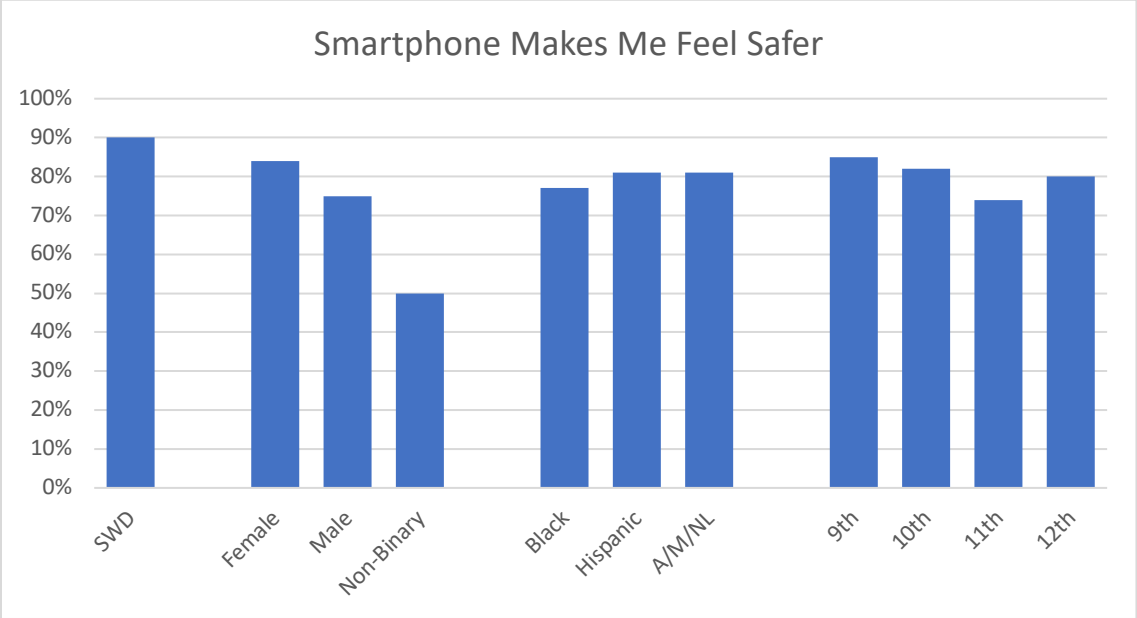
*p< 0.05 **p< 0.01 ***p<0.001

Overall, there are no significant differences amongst students regarding smartphone use policies in school. Students may feel they have no power or voice to influence school policies because tend not to listen to them anyway. The mutual feeling amongst students is that ban mobile phone policies are outdated and irreverent for their generation who are constantly using their smartphones. Students overall within all grades feel safer in school with their smartphones and do not believe smartphones are a distraction in school.

Figure 4-13 below shows that across all demographics except non-binary gender, over 75% of students agrees or strongly agrees that having their smartphone with them in school make them feel safer. This further shows that all students regardless of disability, gender, race/ethnicity, or grade level share a common comfort level of having their smartphone with them in school at all time.

Figure 4-13

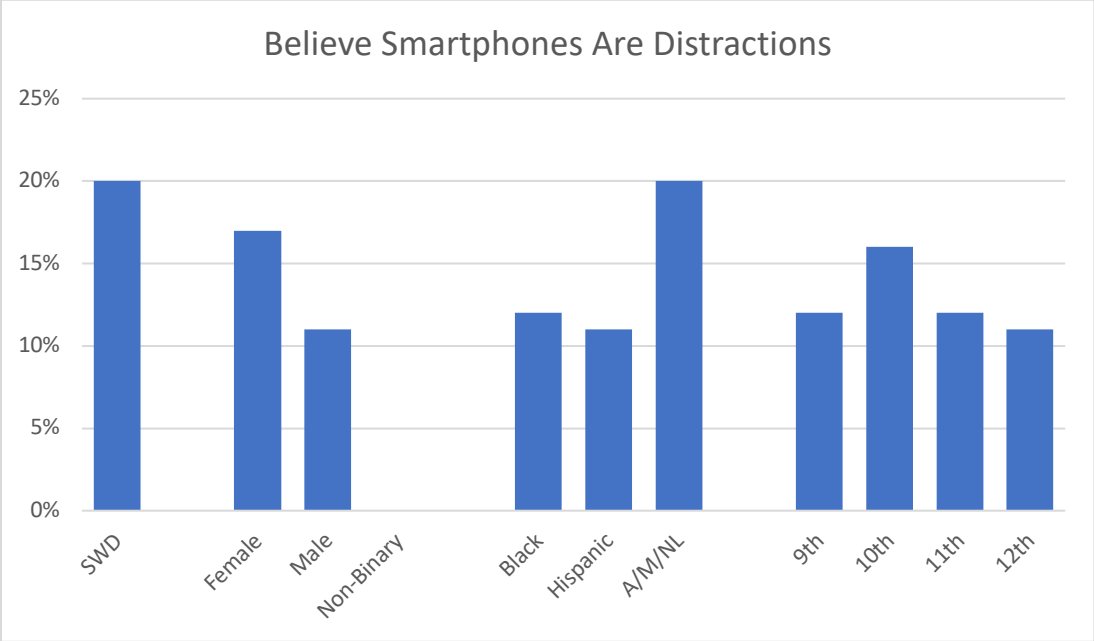
Percentage of Students Agree and Strongly Agree Smartphones Make Them Feel Safer by Demographics



On average, less than 15% of students across all demographic areas believe that smartphones are a distraction in school. Students with disabilities and students within the Asian/Mixed/Not-Listed group were the highest percentage of 20%. Followed closely by female students at about 16% who believe smartphones are a distraction in school. These increased differences can be the result of students with disabilities tend to have more attention disorder than other students and female students tend to have more social media drama than other students. Whereas the smaller sample population of Asian/Mixed/Not-Listed in the study may mainly consist of students with disabilities and female students.

Figure 4-14

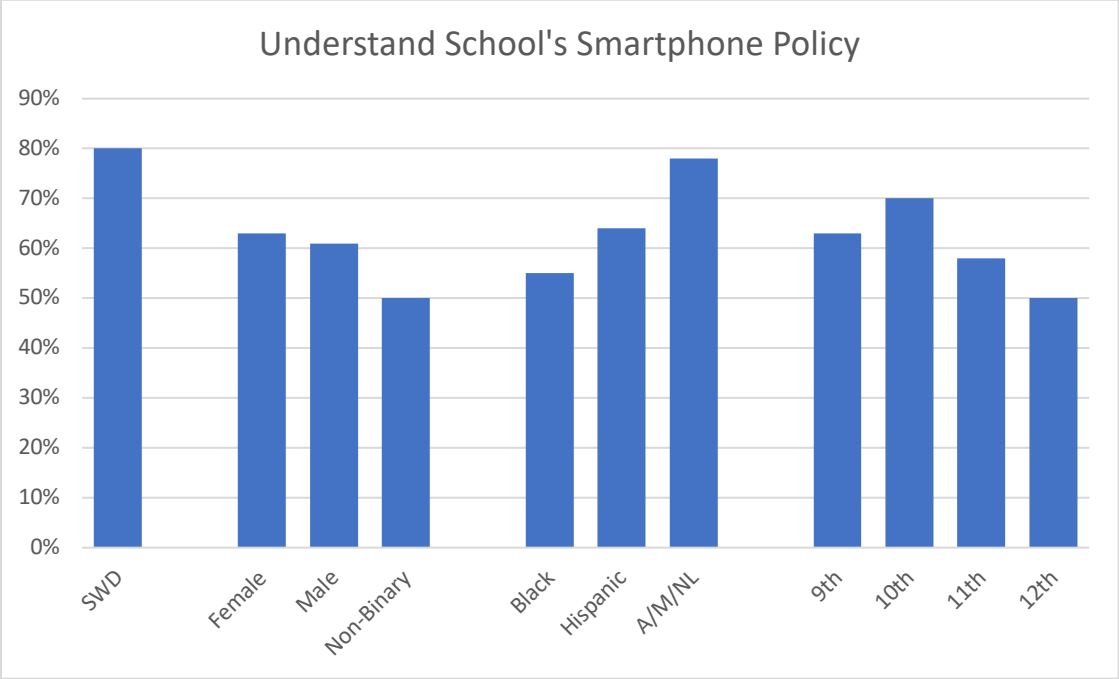
Percentage of Students Agree and Strongly Agree that Smartphones are a Distraction by Demographics



About 80% of students with disabilities and students within the Asian/Mixed/Not-Listed group indicated they understood the school's smartphone policy. On average slightly under 60% of other student demographics indicated understanding of smartphone use policies in school. This low percentages can be the result of the inconsistency that students mentioned of the enforcement of any mobile phone policy across the school. Another reason is that students are taken the position of using their smartphones in school regardless of what policy exist.

Figure 4-15

Percentage of Students Agree and Strongly Agree that They Understand the School's Smartphone Policies by Demographics



Factors Influencing Perceptions on Connectiveness of Smartphone Technology

Disability Effects on Connectiveness

The T-test was completed to analyze the mean scores of students who self-identified as having a physical and/or a learning disability as compared to students who do not for each Connectiveness variables. The results of these T-tests are summarized below in Table 4-60. There was no significant difference in all smartphone connectiveness variables except one: Teacher Allowed. Statistical significance was found for the variable Teacher Allowed where the p-value was calculated as 0.026, less than 0.05. On average, students with disabilities will use their smartphone if allowed by their teachers most of time (scaled mean

of 12.300) as compared to students without disabilities, who will only use their smarphone some of the times (scaled mean of 10.595); this variable is significantly lower for students without disabilities. For the other connectiveness variables, the p-values were greater than 0.05, ranging from 0.154 to 0.937.

Table 4-60

Summary of t-Test for Students with or without Disabilities and the Connectiveness Variables

Variables	Student without Disabilities			Students with Disabilities					
	M	*SD*	*N*	*M*	*SD*	*N*	*df*	*t*	*p*
Connections me	21.497	4.301	153	23.000	4.269	10	161	-1.071	0.286
Connections society	7.255	1.703	153	7.300	2.406	10	161	-0.079	0.937
Connections classroom	19.036	4.161	153	19.300	5.438	10	161	-0.191	0.849
Teacher encouraged	5.079	1.955	152	6.000	2.211	10	160	-1.432	0.154
Teacher allowed	10.595	2.335	153	12.300	2.263	10	161	-2.241	0.026*

*p < 0.05 **p< 0.01 ***p<0.001

Table 4-61

Summary of Chi Square for Connections to Me for Students with Disabilities

Smartphone Enables Connections to Me for Students with Disabilities								
Independent Variable	**1**	**2**	**3**	**4**	**5**	**Total**	X^2	***p***
No Disability	0	6	57	71	19	153	3.117	0.374
% Likert Score	0.0%	3.9%	37.3%	46.4%	12.4%	100.0%		
Disability	0	0	4	3	3	10		
% Likert Score	0.0%	0.0%	40.0%	30.0%	30.0%	100.0%		
Total	0	6	61	74	22	163		
% Likert Score	0.0%	3.7%	37.4%	45.4%	13.5%	100.0%		

*p< 0.05 **p< 0.01 ***p<0.001

A chi square analysis was conducted to see if there were significant differences between students with disabilities versus students without disabilities on whether smartphones enable connections to themselves. The crosstab results of the chi square test with frequency are shown above in Table 4.61. The chi square test showed that there is no significant difference (X^2=3.117, p>0.05).

Table 4-62

Summary of Chi Square for Connections to Society for Students with Disabilities

Smartphone Enables Connections to Society for Students with Disabilities								
Independent Variable	**1**	**2**	**3**	**4**	**5**	**Total**	X^2	***p***
No Disability	2	13	62	56	18	152	41.346	0.001***
% Likert Score	1.3%	8.6%	40.8%	36.8%	11.8%	100.0%		
Disability	0	2	3	2	3	10		
% Likert Score	0.0%	20.0%	30.0%	20.0%	30.0%	100.0%		
Total	2	25	65	58	21	162		
% Likert Score	1.2%	15.4%	40.1%	35.8%	13.0%	100.0%		

*p< 0.05 **p< 0.01 ***p<0.001

A chi square analysis was conducted to see if there were significant differences between students with disabilities versus students without disabilities on whether smartphones enable connections to society. The crosstab results of the chi square test with frequency are shown above in Table 4.62. The chi square test showed that there is significant difference (X^2=41.346, p<0.05).

Table 4-63

Summary of Chi Square for Connections to Classroom for Students with Disabilities

Smartphone Enables Connections to the Classroom for Students with Disabilities								
Independent Variable	**1**	**2**	**3**	**4**	**5**	**Total**	X^2	*p*
No Disability	1	11	37	73	31	153	5.335	0.255
% Likert Score	0.7%	7.2%	24.2%	47.7%	20.3%	100.0%		
Disability	0	2	2	2	4	10		
% Likert Score	0.0%	20.0%	20.0%	20.0%	40.0%	100.0%		
Total	1	13	39	75	35	163		
% Likert Score	0.6%	8.0%	23.9%	46.0%	21.5%	100.0%		

*p< 0.05 **p< 0.01 ***p<0.001

A chi square analysis was conducted to see if there were significant differences between students with disabilities versus students without disabilities for whether smartphones enable connections to the classroom. The crosstab results of the chi square test with frequency are shown above in Table 4.63. The chi square test showed that there is no significant difference (X^2=5.335, p>0.05).

Table 4-64

Summary of Chi Square for Encouraged by Teachers for Students with Disabilities

Smartphone Use Encouraged by Teachers for Students with Disabilities								
Independent Variable	**1**	**2**	**3**	**4**	**5**	**Total**	X^2	***p***
No Disability	19	42	59	27	5	152	3.049	0.550
% Likert Score	12.5%	27.6%	38.8%	17.8%	3.3%	100.0%		
Disability	1	1	4	3	1	10		
% Likert Score	10.0%	10.0%	40.0%	30.0%	10.0%	100.0%		
Total	20	43	63	30	6	162		
% Likert Score	12.3%	26.5%	38.9%	18.5%	3.7%	100.0%		

*p< 0.05 **p< 0.01 ***p<0.001

A chi square analysis was conducted to see if there were significant differences between students with disabilities versus students without disabilities on whether smartphone use is encouraged by teachers. The crosstab results of the chi square test with frequency are shown above in Table 4.64. The chi square test showed that there is no significant difference (X^2=3.049, p>0.05).

Table 4-65

Summary of Chi Square for Allowed by Teachers for Students with Disabilities

Smartphone Use Allowed by Teachers for Students with Disabilities								
Independent Variable	**1**	**2**	**3**	**4**	**5**	**Total**	X^2	***p***
No Disability	0	16	59	59	19	153	6.976	0.073
% Likert Score	0.0%	10.5%	38.6%	38.6%	12.4%	100.0%		
Disability	0	0	2	4	4	10		
% Likert Score	0.0%	0.0%	20.0%	40.0%	40.0%	100.0%		
Total	0	16	61	63	23	163		
% Likert Score	0.0%	9.8%	37.4%	38.7%	14.1%	100.0%		

*p< 0.05 **p< 0.01 ***p<0.001

A chi square analysis was conducted to see if there were significant differences between students with disabilities versus students without disabilities on whether students would use their smartphone more if allowed by teachers. The crosstab results of the chi square test with frequency are shown above in Table 4.65. The chi square test showed that there is no significant difference (X^2=6.976, p>0.05).

Students with disabilities are feeling connected to others as well with their smartphone. Outside of games, there are other applications that students use on their smartphone to connect with their friends, their family and with their school. It was surprising to significance difference for students with disabilities with respect to society. This could be the result from the reason that students with learning disabilities experiences introversion more than student without. Students with disabilities are using their smartphone about 10% more than students without to connect with society in general.

Race Effects on Connectiveness

ANOVA tests were completed to compare means for the three race/ethnicity groups and the Connectiveness variables. The results are summarized in Table 4-66 below. There was no significant difference in all variables. The p-value was greater than 0.05, ranging from 0.174 to 0.551.

Table 4-66

Summary of ANOVA Results for Race Ethnicity and Mean Score of Connectiveness Variables

Variables	**Race/Ethnicity**	*N*	*M*	*SD*	*F ratio*	*p*
	AsianPacific/Mixed/NotListed	39	21.795	4.851	1.459	0.235

Connections	Black/African-American	77	20.909	4.404		
me	Hispanic/LatinX	53	22.208	4.064		
Connections	AsianPacific/Mixed/NotListed	39	7.256	1.902	0.671	0.512
society	Black/African-American	77	7.078	1.848		
	Hispanic/LatinX	53	7.453	1.705		
Connections	AsianPacific/Mixed/NotListed	39	19.154	4.088	1.290	0.278
classroom	Black/African-American	77	18.539	4.191		
	Hispanic/LatinX	53	19.717	4.087		
Teacher	AsianPacific/Mixed/NotListed	39	5.026	2.032	1.770	0.174
encouraged	Black/African-American	77	4.948	1.939		
	Hispanic/LatinX	52	5.577	1.840		
Teacher	AsianPacific/Mixed/NotListed	39	10.846	2.631	0.597	0.551
allowed	Black/African-American	77	10.571	2.221		
	Hispanic/LatinX	53	11.019	2.282		

*$p < 0.05$

The next chi square analysis was conducted to see if there were significant differences between students' race/ethnicity on whether smartphones enable connections to themselves. The crosstab results of the chi square test with frequency are shown in Table 4.67 below. The chi square test showed that there is no significant difference (X^2=5.061, p>0.05) between the race/ethnicity of students.

Table 4-67

Summary of Chi Square for Connections to Me for Race/Ethnicity

Smartphone Enables Connections to Me for Race/Ethnicity								
Independent Variable	**1**	**2**	**3**	**4**	**5**	**Total**	***X²***	***p***
AsianPac/Mixed/Not	0	1	14	16	8	39	5.061	0.536

% Likert Score	0.0 %	2.6%	35.9%	41.0%	20.5%	100.0%
Black/African Amer	0	5	30	35	7	77
% Likert Score	0.0%	6.5%	39.0%	45.5%	9.1%	100.0%
Hispanic/LatinX	0	1	18	26	8	53
% Likert Score	0.0%	1.9%	34.0%	49.1%	15.1%	100.0%
Total	0	7	62	77	23	169
% Likert Score	0.0%	4.1%	36.7%	45.6%	13.6%	100.0%

*p< 0.05 **p< 0.01 ***p<0.001

The next chi square analysis was conducted to see if there were significant differences between students' race/ethnicity on whether smartphones enable connections to society. The crosstab results of the chi square test with frequency are shown in Table 4.68 below. The chi square test showed that there is no significant difference (X^2=5.061, p>0.05) between the race/ethnicity of students.

Table 4-68

Summary of Chi Square for Connections to Society for Race/Ethnicity

Smartphone Enables Connections to Society for Race/Ethnicity								
Independent Variable	**1**	**2**	**3**	**4**	**5**	**Total**	X^2	***p***
AsianPac/Mixed/Not	1	2	15	15	6	39	51.942	0.065
% Likert Score	2.6 %	5.1%	38.5 %	38.5 %	15.4 %	100.0 %		
Black/African Amer	1	9	32	26	8	76		
% Likert Score	1.3%	11.8 %	42.1 %	34.2 %	10.5 %	100.0 %		
Hispanic/LatinX	0	5	21	19	8	53		
% Likert Score	0.0%	9.4%	39.6 %	19.0 %	15.1 %	100.0 %		
Total	2	16	68	60	22	168		
% Likert Score	11.9 %	9.5%	40.5 %	35.7 %	13.1 %	100.0 %		

*p< 0.05 **p< 0.01 ***p<0.001

The next chi square analysis was conducted to see if there were significant differences between students' race/ethnicity on for whether smartphones enable connections to the classroom. The crosstab results of the chi square test with frequency are shown in Table 4.69 below. The chi square test showed that there is no significant difference (X^2=4.138, p>0.05) between the race/ethnicity of students.

Table 4-69

Summary of Chi Square for Connections to Classroom for Race/Ethnicity

Smartphone Enables Connections to the Classroom for Race/Ethnicity								
Independent Variable	**1**	**2**	**3**	**4**	**5**	**Total**	X^2	*p*
AsianPac/Mixed/Not	0	3	10	17	9	39	4.138	0.658
% Likert Score	0.0 %	7.7%	25.6%	43.6%	23.1%	100.0%		
Black/African Amer	0	7	22	35	13	77		
% Likert Score	0.0%	9.1%	28.6%	45.5%	16.9%	100.0%		
Hispanic/LatinX	0	4	8	28	13	53		
% Likert Score	0.0%	7.5%	15.1%	52.8%	24.5%	100.0%		
Total	0	14	40	80	35	169		
% Likert Score	0.0%	8.3%	23.7%	47.3%	20.7%	100.0%		

*p< 0.05 **p< 0.01 ***p<0.001

The next chi square analysis was conducted to see if there were significant differences between students' race/ethnicity on whether smartphone use is encouraged by teachers. The crosstab results of the chi square test with frequency are shown in Table 4.70 below. The chi square test showed that there is no significant difference (X^2=11.898, p>0.05) between the race/ethnicity of students.

Table 4-70

Summary of Chi Square for Encouraged by Teachers for Race/Ethnicity

Smartphone Use Encouraged by Teachers for Race/Ethnicity								
Independent Variable	**1**	**2**	**3**	**4**	**5**	**Total**	X^2	***p***
AsianPac/Mixed/Not	3	16	13	4	3	39	11.898	0.156
% Likert Score	7.7%	41.0%	33.3%	10.3%	7.7%	100.0%		
Black/African Amer	11	22	28	15	1	77		
% Likert Score	14.3%	28.6%	36.4%	19.5%	1.3%	100.0%		
Hispanic/LatinX	3	11	23	13	2	52		
% Likert Score	5.8%	21.2%	44.2%	25.0%	3.8%	100.0%		
Total	17	49	64	32	6	168		
% Likert Score	10.1%	29.2%	38.1%	19.0%	3.6%	100.0%		

*p< 0.05 **p< 0.01 ***p<0.001

The next chi square analysis was conducted to see if there were significant differences between students' race/ethnicity on whether students would use their smartphone more if allowed by teachers. The crosstab results of the chi square test with frequency are shown in Table 4.71 below. The chi square test showed that there is no significant difference (X^2=4.222, p>0.05) between the race/ethnicity of students.

Table 4-71

Summary of Chi Square for Allowed by Teachers for Race/Ethnicity

Smartphone Use Allowed by Teachers for Race/Ethnicity								
Independent Variable	**1**	**2**	**3**	**4**	**5**	**Total**	X^2	***p***
AsianPac/Mixed/Not	0	4	15	12	8	39	4.222	0.647
% Likert Score	0.0%	10.3%	38.5%	30.8%	20.5%	100.0%		
Black/African Amer	0	7	28	35	7	77		
% Likert Score	0.0%	9.1%	36.4%	45.5%	9.1%	100.0%		
Hispanic/LatinX	0	4	19	22	8	53		
% Likert Score	0.0%	7.5%	35.8%	41.5%	15.1%	100.0%		
Total	0	15	62	69	23	169		

% Likert Score	0.0%	8.9%	36.7%	40.8%	13.6%	100.0%

*p< 0.05 **p< 0.01 ***p<0.001

There were no significant differences between the race/ethnical background of students on whether smartphones enable connections to themselves, school, or society. Nor were there any significant differences between the race/ethnical background of students for on whether they were encouraged by their teachers to use their smartphone in class, and if allowed by teachers they would use their smartphone more. Both schools in the study were comprised of mostly Black/African-American and Hispanic/LatinX students. Insomuch that their personal and in-school experiences with their smartphone technology tend to be similar.

Gender Effects on Connectiveness

An ANOVA test was completed to compare means for the three gender identifications and the subcategory variables. The results are summarized in Table 4-72 below. There was no significant difference in all variables except two. The p-value was greater than 0.05, ranging from 0.131 to 0.619. A p-value less than 0.05 is typically considered to be statistically significant, in which case the null hypothesis should be rejected. A p-value greater than 0.05 means that deviation from the null hypothesis is not statistically significant, and the null hypothesis is not rejected. For the Connection Society and Teacher Allowed variables, the p-value were 0.021 (<0.05) and 0.013 (<0.05), respectively, indicating statistically significant between gender identifications of students. A Tukey Post Hoc Test was conducted to further analyze the significance between Connection Society and Teacher Allowed variables with the participants gender identification demographic.

Table 4-72

Summary of ANOVA Results for Gender and Mean Score of Connectiveness Variables

Variable	Gender	N	M	SD	F ratio	p
Connections me	Male	85	22.282	4.055	2.054	0.131
	Female	88	20.955	4.538		
	Non-Binary/Not Listed	2	22.000	5.657		
Connections society	Male	85	7.682	1.529	3.931	0.021*
	Female	88	6.932	1.958		
	Non-Binary/Not Listed	2	7.500	2.121		
Connections classroom	Male	85	19.606	4.016	1.691	0.187
	Female	88	18.432	4.368		
	Non-Binary/Not Listed	2	19.500	6.364		
Teacher encouraged	Male	85	5.212	1.878	0.481	0.619
	Female	87	5.138	2.053		
	Non-Binary/Not Listed	2	6.500	0.707		
Teacher allowed	Male	85	11.318	2.194	4.489	0.013*
	Female	88	10.273	2.448		
	Non-Binary/Not Listed	2	10.000	1.414		

*p< 0.05 **p< 0.01 ***p<0.001

The post hoc test results in Table 4-73 below show that the statistical significance within Connection Society and Teacher Allowed variables lies between the means of Female and Male participants. When comparing female to male students, male students on average used their smartphones significantly less to connect to their community than female students, with average mean scores of 6.932 and 7.682, respectively. When comparing female to male students, male students on average will use their smartphones significantly less if teachers

allow them to in class than female students, with average mean scores of 10.723 and 11.318, respectively.

Table 4-73

Summary of Tukey Post Hoc Test for Connections Society and Teacher Allow with Gender Identity Demographic

Variable	Gender	Gender	M Dif	SE	p
Connections society	Female	Male	0.751	0.268	0.016*
		NonBinary/Not Listed	0.182	1.261	0.989
	Male	Female	-0.751	0.268	0.016*
		NonBinary/Not Listed	-0.568	1.261	0.894
	NonBinary/Not Listed	Female	-0.182	1.261	0.989
		Male	0.568	1.261	0.894
Teacher allowed	Female	Male	1.045	0.353	0.010**
		NonBinary/Not Listed	1.318	1.662	0.708
	Male	Female	-1.045	0.353	0.010**
		NonBinary/Not Listed	0.272	1.661	0.985
	NonBinary/Not Listed	Female	-1.318	1.662	0.708
		Male	-0.273	1.661	0.985

*p< 0.05 **p< 0.01 ***p<0.001

A chi square analysis was conducted to see if there was significant differences between students' gender classifications on whether smartphones enable connections to themselves. The crosstab results of the chi square test with frequency are shown below in Table 4-47. The chi square test showed that there is no significant difference between Male, Female and Non-Binary students (X^2=6.846, p>0.05).

Male students indicated that they are less likely to use their smartphone in school if allowed by their teachers than female students, as well as less likely to agree that their smartphone enable them to connect to society. This could be an indication of bias generally against male of color in schools.

Table 4-74

Summary of Chi Square for Connections to Me for Gender

Smartphone Enables Connections to Me for Gender								
Independent Variable	**1**	**2**	**3**	**4**	**5**	**Total**	X^2	*p*
Female	0	1	27	43	14	85	6.846	0.335
% Likert Score	0.0%	1.2%	31.8%	50.6%	16.5%	100.0%		
Male	0	6	36	37	9	88		
% Likert Score	0.0%	6.8%	40.9%	42.0%	10.2%	100.0%		
Non-Binary/Not List	0	0	1	1	0	2		
% Likert Score	0.0%	0.0%	50.0%	50.0%	0.0%	100.0%		
Total	0	7	64	81	23	175		
% Likert Score	0.0%	4.0%	36.6%	46.3%	13.1%	100.0%		

*p< 0.05 **p< 0.01 ***p<0.001

A chi square analysis was conducted to see if there were significant differences between students' gender classifications on whether smartphones enable connections to society. The crosstab results of the chi square test with frequency are shown below in Table 4-75. The chi square test showed that there is significant difference between Male, Female and Non-Binary students (X^2=54.790, p<0.05).

Table 4-75

Summary of Chi Square for Connections to Society for Gender

Smartphone Enables Connections to Society for Gender								
Independent Variable	**1**	**2**	**3**	**4**	**5**	**Total**	X^2	***p***
Female	0	4	29	37	14	84	54.790	0.038*
% Likert Score	0.0%	4.8%	34.5%	44.0%	16.7%	100.0%		
Male	2	12	38	25	10	87		
% Likert Score	2.3%	13.8%	43.7%	28.0%	11.5%	100.0%		
Non-Binary/Not List	0	0	1	1	0	2		
% Likert Score	0.0%	0.0%	50.0%	50.0%	0.0%	100.0%		
Total	2	16	68	63	24	173		
% Likert Score	1.2%	9.2%	39.3%	36.4%	13.9%	100.0%		

*p< 0.05 **p< 0.01 ***p<0.001

A chi square analysis was conducted to see if there were significant differences between students' gender classifications on whether smartphones enable connections to the classroom. The crosstab results of the chi square test with frequency are shown below in Table 4-76. The chi square test showed that there is no significant difference between Male, Female and Non-Binary students (X^2=6.158, p>0.05).

Table 4-76

Summary of Chi Square for Connections to Classroom for Gender

Smartphone Enables Connections to the Classroom for Gender								
Independent Variable	**1**	**2**	**3**	**4**	**5**	**Total**	X^2	***p***
Female	0	5	17	44	19	85	6.158	0.630
% Likert Score	0.0%	5.9%	20.0%	51.8%	22.4%	100.0%		
Male	1	9	23	39	16	88		
% Likert Score	1.1%	10.2%	26.1%	44.3%	18.2%	100.0%		
Non-Binary/Not List	0	0	1	0	1	2		
% Likert Score	0.0%	0.0%	50.0%	0.0%	50.0%	100.0%		

Total	1	14	41	83	36	175
% Likert Score	0.6%	8.0%	23.4%	47.4%	20.6%	100.0%

*p< 0.05 **p< 0.01 ***p<0.001

A chi square analysis was conducted to see if there were significant differences between students' gender classifications on whether smartphone use is encouraged by teachers. The crosstab results of the chi square test with frequency are shown below in Table 4-77. The chi square test showed that there is no significant difference between Male, Female and Non-Binary students (X^2=3.780, p>0.05).

Table 4-77

Summary of Chi Square for Encouraged by Teachers for Gender

Smartphone Use Encouraged by Teachers for Gender								
Independent Variable	**1**	**2**	**3**	**4**	**5**	**Total**	***X²***	***p***
Female	8	23	37	14	3	85	3.780	0.876
% Likert Score	9.4%	27.1%	43.5%	16.5%	3.5%	100.0%		
Male	11	24	30	4	4	87		
% Likert Score	12.6%	27.6%	34.5%	20.7%	4.6%	100.0%		
Non-Binary/Not List	0	0	1	1	0	2		
% Likert Score	0.0%	0.0%	50.0%	50.0%	0.0%	100.0%		
Total	19	47	68	33	7	175		
% Likert Score	10.9%	27.0%	39.1%	19.0%	4.0%	100.0%		

*p< 0.05 **p< 0.01 ***p<0.001

A chi square analysis was conducted to see if there were significant differences between students' gender classifications on whether students would use their smartphone more if allowed by teachers. The crosstab results of the chi square test with frequency are

shown below in Table 4-78. The chi square test showed that there is no significant difference between Male, Female and Non-Binary students (X^2=8.592, p>0.05).

Table 4-78

Summary of Chi Square for Allowed by Teachers for Gender

Smartphone Use Allowed by Teachers for Gender								
Independent Variable	**1**	**2**	**3**	**4**	**5**	**Total**	X^2	*p*
Female	0	4	27	38	16	85	8.592	0.198
% Likert Score	0.0%	4.7%	31.8%	44.7%	18.8%	100.0%		
Male	0	12	36	31	9	88		
% Likert Score	0.0%	13.6%	40.9%	35.2%	10.2%	100.0%		
Non-Binary/Not List	0	0	1	1	0	2		
% Likert Score	0.0%	0.0%	50.0%	50.0%	0.0%	100.0%		
Total	0	16	64	70	25	175		
% Likert Score	0.0%	9.1%	36.6%	40.0%	14.3%	100.0%		

*p< 0.05 **p< 0.01 ***p<0.001

Grade-Levels Effects on Connectiveness

An ANOVA test was completed to compare means for the participants grade level and the Connectiveness variables. The results are summarized in Table 4-79 below. There was no significant difference in all category variables. The p-value was greater than 0.05, ranging from 0.057 to 0.700. A p-value greater than 0.05 means that deviation from the null hypothesis is not statistically significant, and the null hypothesis is not rejected.

Table 4-79

Summary of ANOVA Results for Grade Level and Mean Score of Connectiveness Variables

Variable	Grade Level	*N*	*M*	*SD*	*F ratio*	*p*
Connections	9th Grade	41	22.268	4.301	0.693	0.557

me	10th Grade	72	21.542	4.657		
	11th Grade	24	21.458	3.671		
	12th Grade	37	20.838	4.375		
Connections society	9th Grade	41	7.414	1.658	1.126	0.340
	10th Grade	72	7.444	1.783		
	11th Grade	24	7.167	1.904		
	12th Grade	37	6.811	1.970		
Connections classroom	9th Grade	41	19.098	4.236	0.476	0.700
	10th Grade	72	19.063	4.051		
	11th Grade	24	19.833	3.908		
	12th Grade	37	18.514	4.712		
Teacher encouraged	9th Grade	40	4.675	1.685	1.331	0.266
	10th Grade	72	5.250	2.115		
	11th Grade	24	5.625	2.183		
	12th Grade	37	5.189	1.713		
Teacher allowed	9th Grade	41	11.415	2.429	2.560	0.057
	10th Grade	72	10.958	2.475		
	11th Grade	24	10.125	1.801		
	12th Grade	37	10.216	2.097		

*p< 0.05 **p< 0.01 ***p<0.001

The next chi square analysis was conducted to see if there were significant differences between students' grade levels on whether smartphones enable connections to themselves. The crosstab results of the chi square test with frequency are shown in Table 4-80 below. The chi square test showed that there is no significant difference (X^2=6.374, p>0.05) between the grade levels of students.

Table 4-80

Summary of Chi Square for Connections to Me for Grade Levels

Smartphone Enables Connections to Me for Grade Levels								
Independent Variable	**1**	**2**	**3**	**4**	**5**	**Total**	X^2	***p***
9th Grade	0	1	12	22	6	41	6.374	0.702
% Likert Score	0.0%	2.4%	29.3%	53.7%	14.6%	100.0%		
10th Grade	0	3	28	31	10	72		
% Likert Score	0.0%	4.2%	38.9%	43.1%	13.9%	100.0%		
11th Grade	0	1	7	14	2	24		
% Likert Score	0.0%	4.2%	29.2%	58.3%	8.3%	100.0%		
12th Grade	0	2	18	12	5	37		
% Likert Score	0.0%	5.4%	48.6%	32.4%	13.5%	100.0%		
Total	0	7	65	79	23	174		
% Likert Score	0.0%	4.0%	37.4%	45.4%	13.2%	100.0%		

*p< 0.05 **p< 0.01 ***p<0.001

The next chi square analysis was conducted to see if there were significant differences between students' grade levels on whether smartphones enable connections to society. The crosstab results of the chi square test with frequency are shown in Table 4-81 below. The chi square test showed that there is no significant difference (X^2=68.826, p>0.05) between the grade levels of students.

Table 4-81

Summary of Chi Square for Connections to Society for Grade Levels

Smartphone Enables Connections to Society for Grade Levels								
Independent Variable	**1**	**2**	**3**	**4**	**5**	**Total**	X^2	***p***
9th Grade	0	3	18	13	6	40	68.826	0.136
% Likert Score	0.0%	7.5%	45.0%	32.5%	15.0%	100.0%		
10th Grade	0	4	28	26	13	71		
% Likert Score	0.0%	5.6%	39.4%	36.6%	18.3%	100.0%		
11th Grade	1	3	7	11	2	24		

% Likert Score	4.1%	12.5%	29.2%	45.8%	8.3%	100.0%
12th Grade	1	6	16	11	3	37
% Likert Score	2.7%	16.2%	43.2%	29.7%	8.1%	100.0%
Total	2	16	69	61	24	172
% Likert Score	1.2%	9.3%	40.1%	35.5%	14.0%	100.0%

*p< 0.05 **p< 0.01 ***p<0.001

The next chi square analysis was conducted to see if there were significant differences between students' grade levels on whether smartphones enable connections to the classroom. The crosstab results of the chi square test with frequency are shown in Table 4-82 below. The chi square test showed that there is no significant difference (X^2=8.091, p>0.05) between the grade levels of students.

Table 4-82

Summary of Chi Square for Connections to Classroom for Grade Levels

Smartphone Enables Connections to Classroom for Grade Levels								
Independent Variable	**1**	**2**	**3**	**4**	**5**	**Total**	X^2	*p*
9th Grade	1	3	8	22	7	41	8.091	0.778
% Likert Score	2.4%	7.3%	19.5%	53.7%	17.1%	100.0%		
10th Grade	0	4	19	34	15	72		
% Likert Score	0.0%	5.6%	26.4%	47.2%	20.8%	100.0%		
11th Grade	0	1	5	12	6	24		
% Likert Score	0.0%	4.2%	20.8%	50.0%	25.0%	100.0%		
12th Grade	0	5	10	14	8	37		
% Likert Score	0.0%	13.5%	27.0%	37.8%	21.6%	100.0%		
Total	1	13	42	82	36	174		
% Likert Score	0.6%	7.5%	24.1%	47.1%	20.7%	100.0%		

*p< 0.05 **p< 0.01 ***p<0.001

The next chi square analysis was conducted to see if there were significant differences between students' grade levels on whether smartphone use is encouraged by teachers. The crosstab results of the chi square test with frequency are shown in Table 4-83

below. The chi square test showed that there is no significant difference (X^2=15.402, p>0.05) between the grade levels of students.

Table 4-83

Summary of Chi Square for Encouraged by Teachers for Grade Levels

Smartphone Use Encouraged by Teachers for Grade Levels								
Independent Variable	**1**	**2**	**3**	**4**	**5**	**Total**	X^2	*p*
9th Grade	4	18	12	6	0	40	15.402	0.220
% Likert Score	10.0%	45.0%	30.3%	15.0%	0.0%	100.0%		
10th Grade	9	17	30	11	5	72		
% Likert Score	12.5%	23.6%	41.7%	15.3%	6.9%	100.0%		
11th Grade	2	6	8	6	2	24		
% Likert Score	8.3%	25.0%	33.3%	25.0%	8.3%	100.0%		
12th Grade	4	7	17	9	0	37		
% Likert Score	10.8%	18.9%	45.9%	24.3%	0.0%	100.0%		
Total	19	48	67	32	7	173		
% Likert Score	11.0%	27.7%	38.7%	18.5%	4.0%	100.0%		

*p< 0.05 **p< 0.01 ***p<0.001

The next chi square analysis was conducted to see if there were significant differences between students' grade levels on whether students would use their smartphone more if allowed by teachers. The crosstab results of the chi square test with frequency are shown in Table 4-84 below. The chi square test showed that there is significant difference (X^2=20.212, p<0.05) between the grade levels of students.

Table 4-84

Summary of Chi Square for Allowed by Teachers for Grade Levels

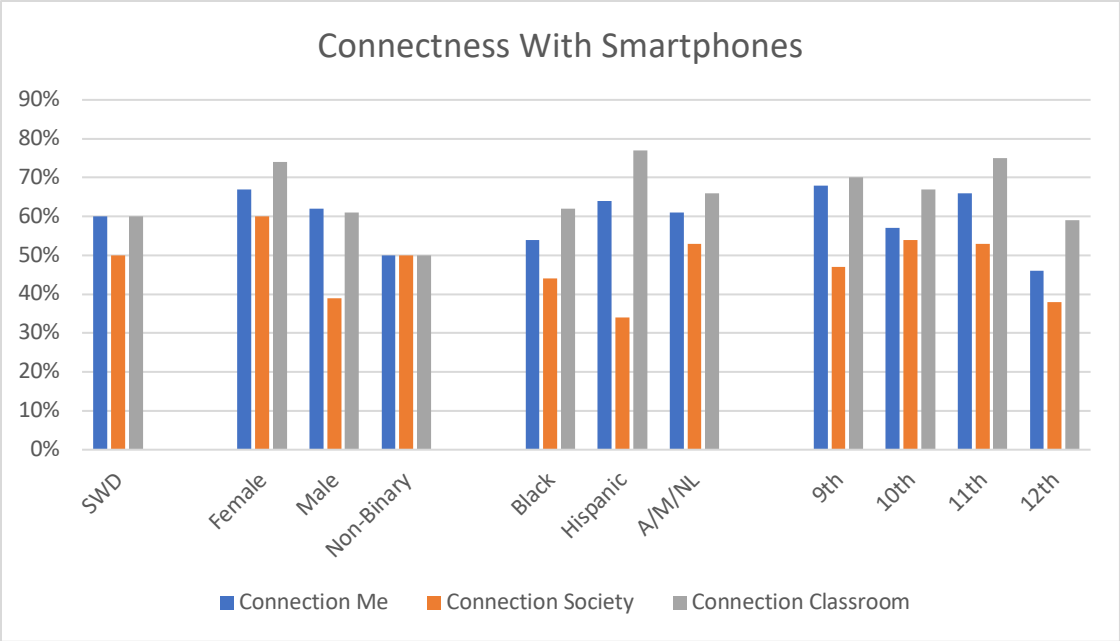
Smartphone Use Allowed by Teachers for Grade Levels								
Independent Variable	**1**	**2**	**3**	**4**	**5**	**Total**	X^2	p
9th Grade	0	2	12	18	9	41	20.212	0.017
% Likert Score	0.0%	4.9%	29.3%	43.9%	22.0%	100.0%		
10th Grade	0	7	24	28	13	72		
% Likert Score	0.0%	9.7%	33.3%	38.9%	18.1%	100.0%		
11th Grade	0	0	16	6	2	24		
% Likert Score	0.0%	0.0%	66.7%	25.0%	8.3%	100.0%		
12th Grade	0	6	13	17	1	37		
% Likert Score	0.0%	16.2%	35.1%	45.9%	2.7%	100.0%		
Total	0	15	65	69	25	174		
% Likert Score	0.0%	8.6%	37.4%	39.7%	14.4%	100.0%		

*p< 0.05 **p< 0.01 ***p<0.001

Overall, students feel that their smartphones provide more connectiveness with their classrooms than with society as a whole or even themselves (See Figure 4-16). So even with the constant nagging by teachers to put away their smartphones, students are using their smartphones to stay connected with lesson assignments, school activities, and with other students.

Figure 4-16

Percentages of Students Believe Smartphone Provide Connectiveness to Self, Society and the Classroom by Demographics



Less than 30% of students indicated that their teachers encourage them to use the smartphones in schools, see Figure 4-17 below. This shows that the majority of teachers still not do believe that smartphone technology can be beneficial to students in class. Teachers are still holding on to the belief that smartphones are distraction and causes trouble for students. Figure 4-18 below shows the percentages of students who some or most of the time would use their smartphone in class if allowed by their teachers by student demographics. With just over 50% of students on average indicating they would actually use their smartphone in class if allowed by teachers shows that even students do not believe teachers know how to utilize smartphone technology in class. Or, maybe students are so use to

getting in trouble for using the smartphone in school that psychologically students cannot grasp the shift. However, about 80% of students with disabilities said they would.

Figure 4-17

Percentages of Students Indicate Smartphone Use Encouraged by Teachers by Demographics

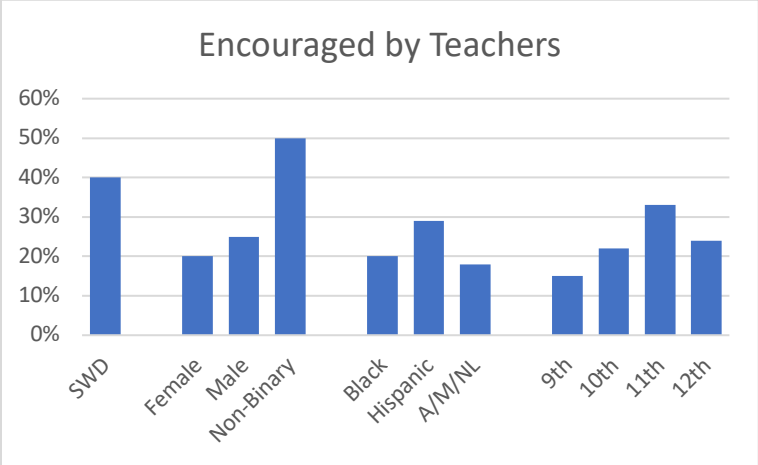
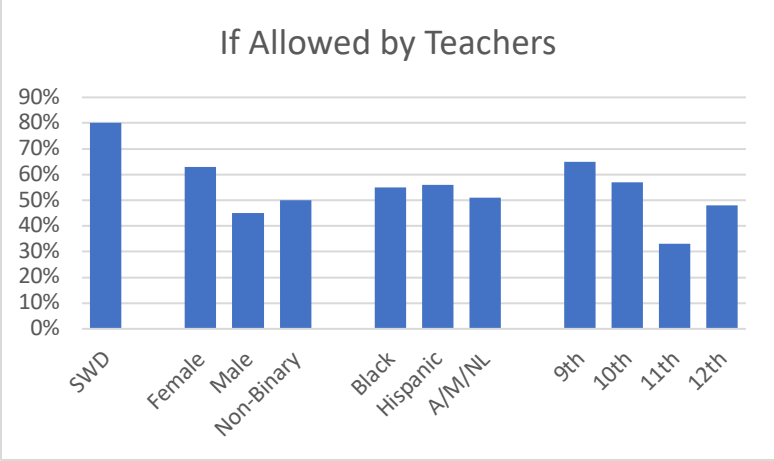


Figure 4-18

Percentages of Students Stated If Allowed by Teacher Will Use Smartphone by Demographics



Summary of the Quantitative Analysis

Students' technology of choice to use to assist with their education is the smartphone. Of the 202 participants in the study, 78.7% indicated that they owned a smartphone which was the highest percentage of technology ownership indicated. About 70% of students in the survey indicated that they used their smartphone most frequently to access the Internet. About 38% indicated they spend more than 5 hours on their smartphone per day, and another 34% said they spend between 3 to 5 hours on their smartphone per day. If families do not own multiple types of portable technologies such as notebook computers, tablet computers, or web tablets (especially families with low social-economic status) then smartphone is the only technology that students may own. In addition to its portability, the ease of use and various availability of applications for both social and educational use make smartphones the preferred technology by students.

On average, students believe that their smartphone is useful in helping them get better grades in their classes and to help understand content material better. The students feel that with their smartphones they are able to access information about their lessons in class without waiting on their teachers. Inclusion, regular education, and sub-separate classrooms all have diverse learners with diverse skill sets. So, teachers have to provide differentiated instructional strategies to reach all students within the class period time. As teachers are supporting one student or a group of students in the classrooms, other students who also need assistance at the same time are utilizing their smartphones to access the content independently.

However, students neither agreed or disagreed that smartphones motivate them to participate or to be more involved in class. This indicates that teachers still have to provide culturally relevant and engaging lesson activities to connect students with the content. But student did strongly agree that their smartphone allows them to collaborate with their peers about class assignments outside of school. This shows that, similar to their comfort level with using their smartphones for social media activities, students are comfortable with using their smartphone phone for educational purposes outside of school.

During remote learning due to the COVID-19 outbreak, most students indicated that it was their smartphones that kept them connected to school for classes, assignments, emails and information. Students preferred using their smartphones for classes even if they had school-issued Chromebook technology during remote learning. However, students indicated that they used their smartphones only some of the time to complete their assignments. This begs the questions on whether the applications or educational platforms used by teachers were accessible or even formatted for use on students' personal smartphones.

Students strongly agree that having their smartphones with them in school make them feel safer. Indicating that they do understand the smartphone use policy in school, students not only still use their smartphones in school but state that should be allowed to use them and not get in trouble for doing so. Today's students are a part of the digital generation with an established youth digital culture. Students find ways to use their smartphones, web tablets and smart watches regardless ofwhere they are, at any given time. Unfortunately for students, teachers and school leaders still see smartphones as nothing more than a distraction in school, students do not. On the contrary, students believe their smartphone use provides both a psychological and physical safe learning environment while in school.

In terms of their smartphones making them feel more connected, students indicate that with smartphones they feel more connected with other students, their families and their communities. However, they neither agree or disagree with smartphones making them feel more connected with their teachers and their school work. Similar result is seen when ask whether teachers should plan more lessons for smartphone use. This in itself is a disconnect because students are finding ways to use their smartphones to help them understand and complete assignments but do not feel the connection to their teachers or school in doing so. Because teachers are constantly asking students to put away their smartphones or saying their smartphones are a distraction, students are perplexed in approaching their teachers in utilizing smartphone more in their lessons.

Although students find smartphones useful in receiving information about their classes, contacting their teachers, and using calendar reminders, students indicate it is rare for teachers to encourage them to use their smartphones for educational purposes. And if allowed, students indicate that they would use their smartphones more to research content on the Internet and to access online learning videos and applications. Since students are on their smartphones most of time for social media, they are willing to use their smartphones for more educational purposes as well. However, teachers are still reluctant to utilize smartphone technology in their lessons for classes.

Examining the responses based on the participants' disabilities, race/ethnicity, gender, and grade level, there were no significant differences amongst the participants' responses within these demographics except for smartphone use during remote learning, using smartphone when allowed by teachers, and smartphone enable connection to society. On average, Black/African-American students used their smartphones significantly less then

Hispanic/LatinX students to connect to school during remote learning. Similarly, male students used their smartphones significantly less then female students to connect to school during remote learning. More information is needed to determine why this difference occurred during remote learning. One assumption could be the level of connection the different groups feel with school or the different level of distraction with at home activities.

On average, students with disabilities will use their smartphone in class if allowed by their teachers most of the time compared with students without disabilities, who only used their smartphone some of the time. This shows that students with individual specific needs to be successful in school find the use of smartphone technology more helpful than other students for academic intervention. Similar, male students indicate that they would use their smartphone significantly less in class than female students if allowed by their teachers, and to connect to their communities. Again, more information is needed here to determine the reason for these differences. One assumption is that male students may see more value in physical connections with class material than female students, or have more opportunities to physically connect with community activities than female students.

Analysis of Open-Response Questions

The three open-response questions asked within Section 3 of the survey were:

1. (Question 58) State why you believe or do not believe that smartphone use in school is important.
2. (Question 59) What recommendation concerning smartphone use in school would you give your Principal/Head of School?
3. (Questions 60) What recommendation would you give your teachers concerning smartphone use in class?

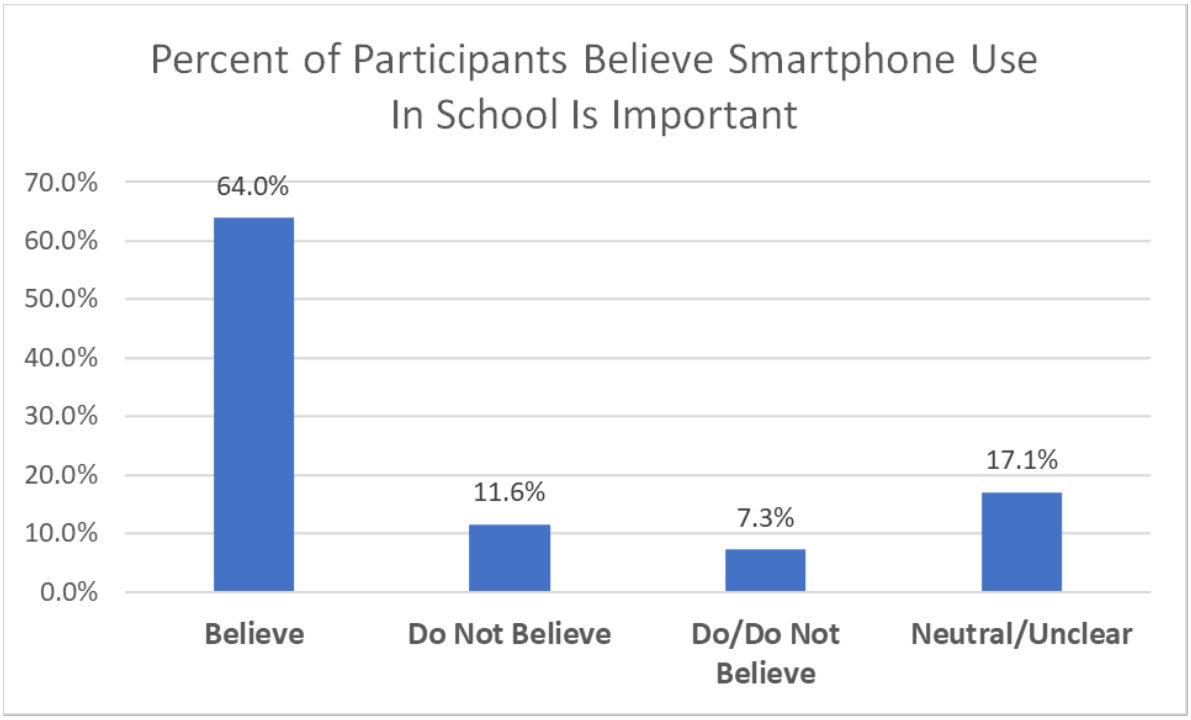
The detailed analysis of the emerging themes identified from the students' responses to these questions is presented in the next three sections in this chapter.

Belief That Smartphone Use in School is Important Result by Themes

When asked in an open-response question, 'State why you believe or do not believe that smartphone use in school is important.', of the 164 students who provided a written response, 64.0% of students indicated that they believe smartphone use in school is important, 11.6% indicated they did not believe smartphone use in school is important, 7.3% both did believe and did not believe (being interpreted as a non-committed response) smartphone use in school is important, and 17.1% indicated a neutral or unclear response. See Figure 4-6 below.

Figure 4-19

Percentage of Participants Who Believe Smartphone Is Important in School



The participants' responses were grouped together in categories to identify the emerging themes. Table 4-85 below depicts the categories of the students' responses and the frequency. Each category contains an example of a participants' response, and the frequency was determined based on similar responses. Related responses were matched with careful consideration to the intent of what was written for the open-response question.

Table 4-85

Frequency of Participants Responses That Smartphone Use in School is Important

Do not believe	
Example response	Frequency, n
"other times it's just a distraction", "you don't need your phone to do everything and you get distracted easily"	15
"It's not important because I can do whatever I need to do on a laptop", "we have computers"	4
"don't think it is important"	2
"if the teacher doesn't allow you to use it in class you shouldn't be using it", "teachers don't really care for it."	1
"it's not a necessity."	1
"It's not really important unless it's an emergency"	1
"we don't need them… it's just preferred"	1
"students are already addicted to them"	1
"everything we are learning in school is easy and you shouldn't need a smartphone"	1
"Because you should just focus on the work… and then use your phone at home."	1
Do believe	
Example response	Frequency, n
"you can learn a lot of different things", "For learning purpose or when we have to look up something online that's about the topic in class", " literally have the collective information of everything humans have learned", "Look up	18

topics we don't understand", "helps you when you look up a word that you struggle with spelling", "resource"	
"is something happening in school", "can stay in touch with what is going on", "It's apart of safety", "gives us a sense of security"	14
"use them in a time that they consider an emergency"	11
"we can do a research about a topic more easy"	11
"Smartphones have become part of our lives", "We are in a generation where technology is taking over priority regular education"	9
"can help you a lot", "with their work", "development in subjects in which we are struggling with"	9
"help connect the student to the material and the teacher", "communication", "communicate with people during school"	9
"can look up help and be able to work independently."	8
"It allows me to focus better", "it helps us concentrate"	7
"have access to your family", "friends"	6
"it's a lot quicker", "complete our assignments faster"	4
"they could help individuals be more interested"	4
"be more engaged in class", "to want to participate in class"	3
"they are always on us and can be easier than using the laptops", "Smartphone are more efficient"	3
"when you get bored it can help you out", "It's important to keep some kids entertained"	3
"being able to use a good resource such as Google", "need the internet to look up questions about their work"	3
"may help ease the anxieties that students may have."	2
"able to be notified when there teachers assign classwork", "find out about the lesson you learn for today."	2
"it can be essential for some students", "benefit to students"	2
"we get things done with our phones", "you can get anything out of it"	2
"some kids get their job done by listening to music and watching videos"	2
"takes notes"	2
"someone who was absent can catch up to the work faster"	2
"it keeps us sane", "students need a mental break from education after a while."	2
"possibly to use useful apps", "…calculator"	2
"apps where you can access various of books to read online"	1
"some content that might be needed for school might be blocked on the chrome books"	1

"has so many possibilities and opportunities to enhance the learning experience."	1
"important for people who are antisocial"	1
"it actually helps us to put things out there to make people see what's going on"	1
"when we don't have a computer we use our phone to do assignment"	1
"it will help with the learning environment"	1
"it gives us more freedom"	1

Of the 71.3% (64% plus 7.3%) of participants who believed that smartphone use in school is important, several themes emerged, see Table 4-86 below. One of the themes that emerged from the most responses is that smartphone use in school is important to help students in class with their assignments. Students indicated that they use smartphones to research topics, to get help with content they are struggling with, to look up words, to use online applications and resources, and to be able to work independently. Also, some students indicated that smartphones help them to be more engaged, more focused and more interested in class.

Another theme that emerged is that smartphones use in school is important in case of emergencies. Students indicated that they feel a sense of security having their smartphones and it is a part of their safety. In addition, students noted that smartphone use enables them to stay connected to what is going on around in case something is happening.

The third theme that emerged is that smartphone use in school is important because smartphones are a part of students' lives and are essential to have all the time. Students indicated that they are a part of a generation where technology is taking over, so their smartphones are essential to their lives. Also, some students indicated that smartphones are

easier and more efficient to use than laptop computers, while others stated that they are better able to get things done since smartphones are on them all the time.

The fourth theme that emerged is that smartphone use in school is important for students to stay connected, both internally and externally. Internally, students indicated that with smartphones, they receive communications from teachers about assigned classwork and the lessons. Also, smartphones help students stay connected with other students in school. From an external perspective, students can communicate with both friends and with family members outside the school grounds.

The final theme that emerged is that smartphone use in school is important to help students ease their anxiety. Students wrote that smartphones may help ease some anxiety and keep students sane. In addition, students can listen to music on their smartphones while completing their work. Smartphones are also used to listen to music or watch videos when students need mental breaks or when students are bored. Smartphone use is a way of keeping students entertained.

Table 4-86

Top Emerging Themes of Responses for Smartphone Use in School is Important

Emerging theme	Frequency, %
Smartphone use in school is important to help students in class with their assignments.	51.4
Smartphones use in school is important in case of emergencies.	16.9
Smartphones use in school is important because smartphones are a part of students' lives and are essential to have all the time.	12.2
Smartphones use in school is important for students to stay connected with people in school as well as with their families.	12.2

Smartphones use in school is important to help students ease their anxiety.	6.8

Two emerging themes were observed from the responses by students (11.3%) who indicated that smartphone use in school is not important. The first is that smartphones use in school is not important because they are just a distraction, and students just want to have them to have them. And the other is that smartphones use in school is not necessary because students can use Chromebooks or laptop computers to do all that they need to do while in school.

Students' open response answers further show that urban high school students believe that smartphone technology can be useful in school by helping them with lessons and to help deal with anxiety while in school. Students expressed the belief that smartphones are essential to their lives every day and is important to have their smartphone with them all the time. Whether it is for emergencies or to connect with family members, smartphones provided a sense of security and comfort for students while in school. For today's youth, smartphones are not only a communication device but also a valuable personal asset for students both inside and outside of school.

Recommendations Concerning Smartphone Use in School to Principals/Head of Schools by Themes

When asked in an open-response question, 'What recommendation concerning smartphone use in school would you give your Principal/Head of School?' five themes emerged from students who provided recommendations, see Table 4-87 below. The first theme that emerged more frequently was that smartphone use should just be allowed by

students because it's their right. One student wrote, "Let the kids be great & use their smartphones." Two other students wrote, "Regulate but don't confiscate" and "Just let students define their own future and not try to obligate them to be something different."

Another recommendation for the themes that emerged was that smartphone use should be allowed in school some of the time. Some students recommended that when students finish their assignments, smartphone use should be allowed. Other students indicated that smartphone use should be allowed in the halls or during a free period. And some recommendations were for the principals not to make a big deal out of students using their smartphones. One student wrote, "Don't make a small problem into a big one about phones", and another wrote, "We can use our phones freely in the halls but it's off limit in class."

The third recommendation that emerged is that smartphones use should be incorporated more in lessons. Students recommended that schools find more educational purposes and benefits to use smartphones in the classrooms. Recommendations included using smartphones to conduct research and to use online applications in class. Another recommendation is to use smartphones for books and notes to make the class more interactive. One student wrote, "Include it more in our classwork so it can be beneficial." Another wrote, "Let teachers involve phones in their classwork."

The fourth recommendation is that the use rules for smartphones should stay the same. Some students indicated that smartphone use rules should stay the same due to online bullying and to prohibit students from posting fights. One student wrote, "Don't allow kids to post fights or threats."

The final recommendation that emerged was that principals should have dialogues with students to understand why students use their smartphones in school. Some students recommended that students not get in trouble for using their smartphones, instead school leaders should have conversations with them to find out what is going on. One student wrote, "To understand students more and why they would use their phones so much. Sometimes having a conversation is essential to figuring out why the school is the way it is."

Table 4-87

Recommendations for Principals/Head of Schools Concerning Smartphone Use

Emerging Theme	Frequency[a], %	Frequency[b], %
Stated that they had no recommendations to make at this time.	24.3	NA
Students recommended that smartphones use should just be allowed by students in school because it is their rights.	29.3	39.0
Students recommended that smartphone use should be allowed in school some of the time.	17.9	23.8
Students recommended that smartphone use should be incorporated more in lessons.	15.7	21.0
Students recommended that smartphone use rules should stay the same.	6.4	8.6
Students recommended that principals should have dialogues with students to understand why students use their smartphone in school.	5.7	7.6

NOTE: [a]Frequency based on all responses. Also, 0.7% of responses' intent was unclear and was omitted in the percentage's calculations. [b]Frequency based participants who provided a recommendation.

School leaders have the opportunity to learn some things from students regarding smartphone use in school. Students clearly have a position on mobile phone policies in

school and are willing to have dialogues with school leaders on how to make these policies relevant and effective with their generation. It is clear that students want to be able to use their smartphones in school and are interested in figuring out how to embed smartphone technology within lessons. Just as school leaders, students want to put in place measures to curtail online bullying and inappropriate postings. The only difference though is that students still want to have their smartphone with them all the time.

Recommendations Concerning Smartphone Use in Class to Teachers by Themes

The emerging recommendations to teachers from the participants concerning smartphone use in class were similar to the recommendations made to principals/head of schools and indicated why smartphone use is important. However, students expressed additional specific recommendations that were different (See Table 4-88 below). For one, students recommended that teachers should not be too strict about students using their smartphone in class because it is not a big deal. Another recommendation indicated that teachers should allow smartphone use in class because smartphones are essential to students' lives. Some students indicated that smartphone use should be allowed in class when they are bored and when there is nothing going on in class. Others recommended that teachers should be more consistent with their rules for smartphone use in class, and establish restrictions and control.

Table 4-88

Recommendations for Teachers Concerning Smartphone Use

Emerging Theme	Frequency[a]		Frequency[b]
	n	*%*	*%*
Students recommended that smartphone use should be incorporated more in lessons.	35	21.5%	28.7%
Students recommended that teachers need not be too strict because using smartphones is no big deal.	22	13.5%	18.0%
Students recommended that teachers allow smartphone use because smartphones are a part of students' lives and are essential.	16	9.8%	13.1%
Students recommended that teachers restrict smartphone use and set controls.	15	9.2%	12.3%
Students recommended that smartphone use should be allowed in school some of the time.	12	7.4%	9.8%
Students recommended that smartphones use should just be allowed by students in school because it is their rights.	6	3.8%	4.9%
Students recommended that smartphone use should be allowed when they are bored and when nothing is going on in class.	6	3.8%	4.9%
Students recommended that teachers should have dialogues with students to understand why students use their smartphone in school.	4	2.5%	3.3%
Smartphones use in school is important to help students ease their anxiety.	4	2.5%	3.3%
Students recommended teachers rules on smartphone should be consistent.	2	1.2%	1.6%
Stated that they had no recommendations to make at this time.	35	21.5%	NA
The statement was unclear, and the intent was unknown.	6	3.8%	NA
TOTAL	163	100%	100%

NOTE: [a]Frequency based on all responses. [b]Frequency based participants who provided a recommendation.

Students were a bit more vocal in suggesting recommendations for teachers. The recommendations span from over 28% of students suggesting smartphone use to enhance or help with lessons, to about 18% of students suggest that teachers needed not be too strict with

not allowing their use in class. Also, students felt that their rights were being taken away from them and that restriction of mobile phones was just another way teachers are exerting their power over students. These recommendations are evident of the disconnect between students, the digital natives, and the teachers, some who may be digital immigrants, regarding smartphone technology usefulness. Furthermore, what students may see as an opportunity with technology, teachers only see an endurance because smartphone are not seen as a typical device for educational purposes.

Limitations of Data Analysis

One limitation of the data analysis is that the sample size of students with disabilities or reported as having disabilities is not reflected of the students with disabilities population size of the schools and the school district in which the study was conducted. Another is that the study depends solely on high school student participants to self-report the responses in which no in-school or in-district reports exist to cross tabulate or to compare their responses with. And lastly, the study was conduct through a descriptive method using a questionnaire versus an experimental research method without a control group in one urban school district. Therefore, the generalization of the results may not be reflected of high school students around the nation outside of urban school districts.

Summary

The students indicated on average that they agree that smartphone use in school in classroom is useful and that smartphone use for school during remote learning was useful most of the time. Students on average did not believe that smartphone use in school was a distraction for them or for their teachers and should be allowed to use smartphones in school. Furthermore, students on average believed that smartphones are helpful in getting their

assignments completed and can help with lessons they struggle with. Not only because they get things done more efficiently on their smartphones but also having their smartphone gives them a sense of security.

The data analysis in this chapter included a quantitative analysis of the participants responses to the self-designed on-line web survey of Likert-type scale and three open-response questions. In addition, a qualitative analysis was conducted on the three open-response questions to determine the emerging themes of the students' written responses. The interpretations of the students' responses and how the open-response that emerged are themes related to the other survey questions will be discussed in the next chapter.

CHAPTER 5

DISCUSSION

**"Knowledge is like a garden. If it is not cultivated,
it cannot be harvested." -African Proverb.**

Introduction

As an administrator, instructional coach, and math teacher within several urban high schools, I have witnessed, first-hand, students getting in trouble for just checking the time on their smartphones in school. Some students have received suspensions due to escalated reactions or emotions they exhibit for being asked to put away their smartphones or for refusing to give their smartphones to teachers or administrators. Most of the students were either just browsing on social media, listening to music, watching a video, or texting with a friend on their smartphone without causing harm to others or distracting the class. Some students were actually doing schoolwork on their smartphones. As a proponent of technology, I am embarrassed to say that I was once asking students to put their smartphones away without first understanding why they were using them in class. As an educator, I realized that I should have been incorporating smartphone technology into my lessons instead of asking students to put them away. By purposefully incorporating smartphone use in my classes, smartphones became less of a distraction and more of a useful educational tool.

Although earlier research-based literature indicates that smartphone use by students in school is nothing more than a distraction or is used to cause trouble, high school students

were finding ways to utilize their smartphones not only in their personal lives, but in school as well (Thomas & Munoz, 2016). This research was able to uncover more of why students were using their smartphones in urban high schools and what recommendations students have for school leaders and teachers regarding smartphone use in school. In addition, most of the current literature and research on smartphone use in school was based on college students and from adult perspectives, resulting in a lack of literature from high school students' viewpoint. The purpose of this study is to examine the use of and attitude towards smartphone technology use in school and during remote learning of urban high school students by collecting quantitative evidence in three areas: usefulness of smartphones for school, students' beliefs and understanding of smartphone policies in school, and how smartphones for student enables connections. In addition, this study examines and quantify the themes of the open-response questions within the survey of students' recommendations to principals and teachers.

Responses to the self-designed online web survey were collected from 202 high school student participants at two high schools. The results were analyzed through a series of descriptive statistics, t-tests, and ANOVA analyses. The open-response questions were analyzed through a coding process to identify themes based on students' written responses. Participants self-reported their demographics such as their grade, age, gender, race/ethnicity, learning disability, types of technology accessible at home and at school, technology most frequently used, and how much time was spent on internet related activities. My interpretations of the findings based on students' responses are included in this chapter. Chapter IV provides the detailed quantitative analysis results and a comprehensive list of the resulting themes from the open-response questions.

This chapter summarizes the result of the survey responses of this study, provides the interpretation of the themes from the open-response questions, and examines the results based on smartphone use in education from the students' perspectives. I end this chapter with discussions on the implementations of my research, the research limitations, and further considerations for future studies.

Summary of Findings

Student Participation Demographics

The participants in this online web survey were collected from two urban high schools in the New England area of the United States. The study included 43.6% male students, 42.1% female students and 14.4% non-binary students, students choosing not to or did not answer. Of the participants, 38.3% classified as Black/African-American, 26.2% as Hispanic/LatinX, 8.4% as Mixed, 3.0% as Asian/Pacific Islander, and 24% choosing not to or did not answer. According to grade levels, the study included 20.3% 9th graders, 35.6% 10th graders, 11.9% 11th graders, and 18.3% 12th graders. The comparative analysis of the demographic data for survey participants showed very little difference with several variables. Also, in the study, 78.7% of the participants indicated that they owned smartphone technology while 69.8% of participants indicated that smartphone is the preferred technology to access the Internet.

Table 5-1

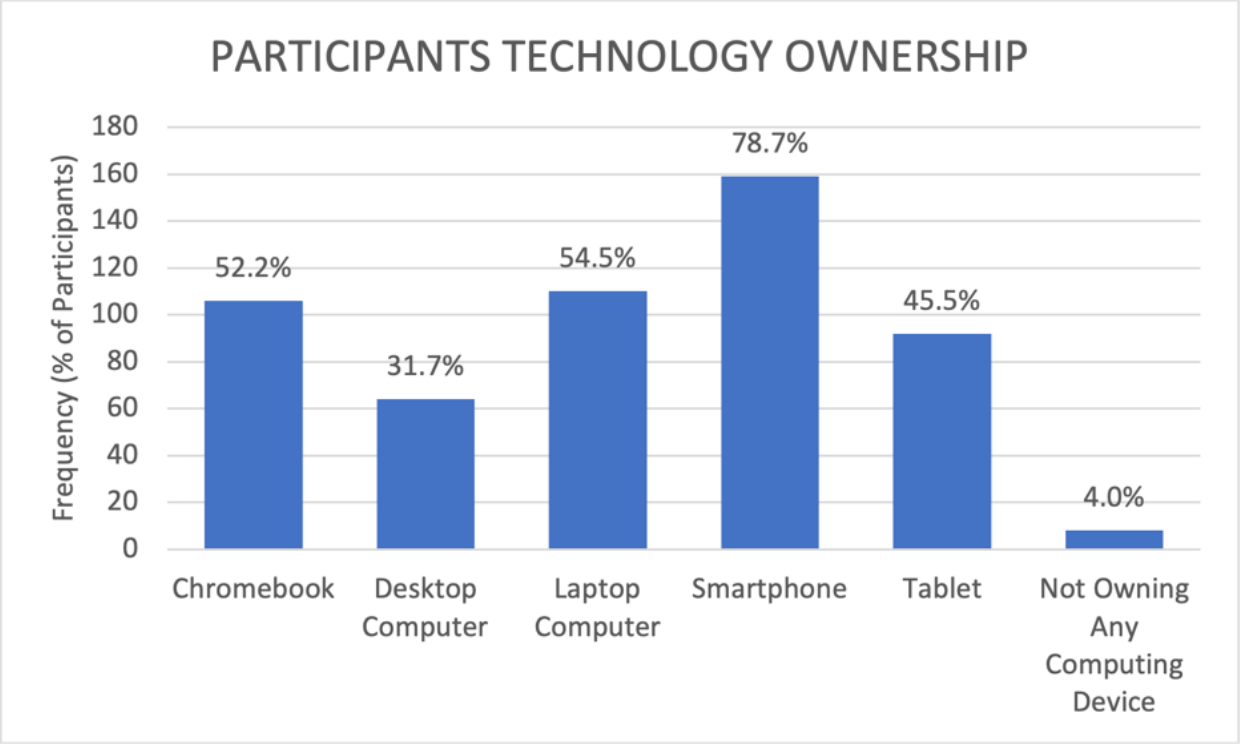
Study Participants Summary

Schools (N)	Students (N)	Gender	%	Race	%	Grade Level	%	Disability	%
2	202	Male	43.6	Black/ AA	38.3	9th	20.3	Has A Disability	5

		Female	42.1	Hispanic/ LatinX	26.2	10th	35.6	No Disability 95
		Non-Binary/ No Answer)	14.4	Mixed	8.4	11th	11.9	
				Asian/ PI	3.0	12th	18.3	
				No Answer	24			

Figure 5-1

Technology Ownership of Participants Percentages



Usefulness of Smartphones for Schools in Classrooms and Remote Learning

Research Question #1: To examine whether students believe smartphone technology is useful in school or during remote learning, quantitative results showed that students believe that smartphone technology can be useful. The survey asked the participants to answer eighteen questions related to smartphone usefulness in school and during remote learning. On average, the students agreed that smartphones can be useful in class during school and during remote learning, see Table 5-2 below.

Table 5-2

Descriptive Statistics Summary for Smartphone Usefulness

Variables	*N*	*M*	*Min*	*Max*	*Range*	*Max/Min*	*Var*
Usefulness classroom	13	3.575	3.105	3.975	0.870	1.280	0.061
Usefulness remote learning	5	3.523	3.025	3.880	0.855	1.283	0.132

With a mean score of 3.575 (variance = 0.061), participants on average agree that smartphones can be useful in the classroom during school. In addition, with a mean score of 3.523 (variance = 0.132), participants indicated that their smartphones were used most of the time for school during remote learning. Quantitative survey results showed that students believe that smartphone technology can be useful in schools for the following:

- to help them get better grades
- to help them understand the lesson material better
- to help them read more books and articles in their classes
- to make lessons more interesting

- to make completing assignments more convenient, and
- to make learning more fun.

In addition, students believe that smartphone technology is useful in helping them collaborate with their classmates with lessons when they are outside of the classroom. However, students neither agreed nor disagreed with smartphone technology being able to help save time during class, to motivate them to participate in class, to get them more actively involved in class, or to help with classroom discussions. On average, students indicated no form of disagreement that smartphones can be useful in the classroom. There were no significant differences among the participants based on their disabilities, race/ethnicity, gender, or grade levels.

For remote learning, statistical analysis revealed that students most of the time used their smartphones during remote learning for the following:

- to check their emails for information about school
- to search for more information online to complete assignments, and
- to stay connected to their classes.

And on average for some of the time during remote learning, students indicated they used their smartphones to access online applications to help with assignments, to complete assignments, and to attend their classes. Further statistical analysis showed that on average Black/African-American students believe their smartphones were significantly less useful during remote learning for school than Hispanic/LatinX students. Furthermore, results showed that male students on average used their smartphones for school during remote learning significantly less than female students. There were no significant differences among the participants based on their disabilities or grade levels.

Smartphone Use Belief on Safety, Distraction, and School Policies

Research Question #2: When participants were asked about their beliefs on smartphone use related to safety, distraction and the policy in school, participants agreed that having their smartphones makes them feel safer in school and that they understand what the smartphone use policy is for school, with means scores of 4.27 (variance = 0.690) and 3.700 (variance = 0.835), respectively. However, with a mean score of 2.676 (variance = 0.076) participants neither agreed nor disagreed on whether smartphone use in school is a distraction, see Table 5-3 below.

Table 5-3

Descriptive Statistics Summary for Safety, Distraction, and School Policy

Variables	*N*	*M*	*Min*	*Max*	*Range*	*Max/Min*	*Var*
Beliefs safe (#23)	1	4.270	2.000	5.000	3.000	2.500	0.690
Beliefs distractions	4	2.676	2.231	2.902	0.580	1.250	0.076
Beliefs policy (#28)	1	3.700	1.000	5.000	4.000	4.000	0.835

The data analysis results indicated that students believed that they should not be getting in trouble for using their smartphones in school and that they should be allowed to use smartphones in school. Furthermore, the results showed that students feel safer in school when they have their smartphones with them, and that they understood the mobile phone policy at their school. However, the results showed that students believe that their smartphone use is not a distraction to other students. For whether smartphone use was a distraction for themselves and their teachers, caused a lot of problems in school, or interfered with their abilities to concentrate in class, students neither agreed nor disagreed. The quantitative data showed that students indicated that they rarely get in trouble for using their

smartphones in class and sometimes see other students getting in trouble for using their smartphones in class. There were no significant differences among the participants based on their disabilities, race/ethnicity, gender, or grade levels.

Using Smartphone for Personal, School and Community Connections

Research Question #3: Descriptive quantitative analysis results revealed that smartphone use makes students feel more connected to their families, society, their community, and to other students with mean scores of 3.593 (variance = 0.194), 3.512 (variance = 0.067), and 3.794 (variance = 0.021), respectively. However, although teachers sometimes encourage students to use smartphones for learning outside of the classroom, teachers rarely encouraged students to use smartphones for learning in class with mean score of 2.599 (variance = 0.069), see Table 5-4.

Table 5-4

Descriptive Statistics Summary for Connections

Variables	*N*	*M*	*Min*	*Max*	*Range*	*Max/Min*	*Var*
Connections me	6	3.593	2.943	4.244	1.301	1.442	0.194
Connections society	5	3.512	3.141	3.827	0.686	1.218	0.067
Connections classroom	5	3.794	3.618	3.952	0.333	1.092	0.021
Teacher encouraged	2	2.599	2.414	2.785	0.371	1.154	0.069
Teacher allowed	3	3.579	3.306	3.780	0.473	1.143	0.060

When asked if they were allowed by their teachers to use their smartphones in class for notes, research or to access audio/video lesson content, the participants indicated they would most of the time, with a mean score of 3.579 (variance = 0.060).

Further questions analysis indicated that students felt smartphone use help connects their cultural identities to society. The data results further showed that smartphone use connects students to entertainment such as games, movies, TV shows, and music, and connects students to community resources. However, students neither agreed or disagreed on whether smartphone use makes them feel more connected to school activities and their teachers, or whether their teachers should plan more to use smartphones in their teaching.

Students neither agreed or disagreed on whether smartphone use is essential to their lives or is a part of who they are. On the other hand, the results showed that students felt that smartphone is useful in connecting with school to receive notifications about class, receive messages about class discussions a day before class, receive calendar reminders on school events, and to setup and hold meetings with teachers. Further quantitative analysis indicated that on average male students used their smartphones to connect to their community significantly less than female students. There were no significant differences among the participants based on their disabilities, race/ethnicity, or grade levels.

On average most of the time, students indicated that they use social media applications such Facebook, Instagram, and Snap Chat daily. However, students indicated that if allowed by teachers, they would use their smartphones most of the time to conduct research on the Internet and access online multimedia recordings to learn more about class content. Further analysis showed students with disabilities on average will use their smartphones if allowed by their teachers significantly more than students without disabilities. In addition, male students on average will use their smartphones in class if allowed by their teachers significantly less than female students. There were no significant differences among the participants based on their race/ethnicity or grade levels.

Summary of Open- Questions Responses

Based on the open-response questions, students felt that smartphone use in school was important because:

- Smartphones help students in class with their assignments.
- Smartphones are needed in case of emergencies and they feel with them.
- Smartphones are a part of students' lives and are essential to have all the time.
- Smartphones are needed to stay connected with people in school, family, and friends.
- Smartphones can ease students' anxiety.

Some recommendations students gave for school leaders and teachers concerning smartphone use includes: 1) just let student use them, it is their rights, 2) incorporate them more in lessons, 3) stop being too strict about them, and 4) have a discussion with students on why they use them.

Discussion of Findings

This study was conducted within the lens of Culturally Responsive Computing from a student's perspective which I dubbed as Culturally Responsive "Learning" with Technology. Using the theoretical frameworks of culturally responsive teaching as the foundation, I sought to uncover the ways that high school students use their smartphone technology as an asset for educational purposes, to provide opportunities for students to reflect on their understanding and beliefs related to mobile phone use policies in school, and to examine how smartphone technology enables connections for students related to their learning experiences in school. The three essential elements of culturally responsive teaching are asset building, reflection, and connection (Ladson-Billings, 2000; Gay, 2010; Scott, 2015). With these

elements in mind, in relationship to smartphone use in education, this study affirms that the assessment of knowledge is not static, it is fluid and multifaceted (Ladson-Billings, 1995).

As culturally responsive educators and school leaders, we should find ways to build upon what students already bring to school. From students' language, cultural traditions, experiences, or personal mobile devices, it is critical that teachers purposely embed students' assets within their classrooms that can lead to students' academic success. Students bring with them and use their smartphone technology in school every day, yet our schools' adaption of their use is minimal. Students often remind me that they are a part of digital generation where social media and multimedia content such as TikTok, Snap Chat, Instagram and YouTube dominates their time on their smartphones. And no matter what the school's mobile phone policy is or the classroom expectations are concerning mobile phone use, students still use their smartphones (Thomas & Munoz, 2016). So, implementing or enforcing a no-mobile-phone use policies across the school becomes challenging. Instead, working with students in incorporating smartphone use into the lessons and school activities can be promising. Students extensively use their smartphones to connect to other students, to their families, to community events, and to entertainment (Scherer and Siddiq, 2019; Vanden-Abeele, 2014; Warschauer, 2003). Now, students are asking to work with teachers and school leaders to use their smartphones to connect to school for their education.

Smartphone Use in Case of Emergencies

I begin with the sad social realities of how urban high school students feel within our schools. Public schools should be a place where students can feel psychologically and physically safe; a place where imagination, creativity, and critical-thinking can thrive within the arc of learning. But all too often schools are using curriculums that are not culturally

relevant to Black and Brown students (Ladson-Billings, 2014). Some teachers' biases and personal beliefs are silently causing students harm in the classrooms. And a week does not go by without another news report of a school shooting or social media video of a violent arrest of a student in school -insomuch that students feel the need always have their smartphone with them in school, just to feel safe. This in itself should be deemed as another public education crisis.

In their open-response answers, students expressed the need to be able to use and have their smartphone on them at school all the time, in case of an emergency and for their safety. As the literature shows, teachers, school leaders, and district leaders' concerns with mobile phone use in school are mainly around smartphones being a distraction to students and potential for online bullying (Ariel & Elishar-Malka, 2019; Kwok et al., 2017; Preston et al., 2015). However, students are more concerned about the safety in school and having their smartphones with them gives them a sense of security. Students feel that if there is something happening in school or around the school, it is their smartphones that will keep them informed. Which is testament to the fact that students do not have the confidence that teachers and school leaders can keep them safe in school nor will inform them in a timely manner if there is an emergency at school. During the literature review examining school district's mobile phone policies, New York' public school system, the largest in the United States, changed their mobile phone policy due to increased community pressure. The primary reasons for the shift states that "this change will better enable parents to stay in touch with their children, especially before and after school" (City of New York, 2015). The reasoning continues with the move to lift the cell phone ban policy is so that families and students can have a sense of comfort and safety by being able to stay in touch throughout the

school day. This shift in policy is aligned with one of students' top responses in this study that their smartphones are needed in case of emergencies.

Today, smartphones and video recording technology have been widely used to capture police brutality, inappropriate remarks by public officials, physical and verbal abuse by authority figures, and fraudulent behaviors by organizations. Students want to be able to use their smartphones to share with others what is really happening in schools. Students' recordings on their smartphones have become the "eye witness" account of violent acts against them or their classmates by some adults in their schools. It is only the instances of fights and TikTok challenges being recorded on their smartphones that get most of the media attention, while the racist, xenophobic, and oppressive comments and actions by staff members towards students that are also getting recorded as well receive less attention. I often hear students say that they reported incidents before and no one believed them or the school leaders did nothing until students were able to capture it on video with their smartphones. Smartphones often serve as a sense of protection for students in urban schools.

Smartphone Use to Help with Lessons

Students indicated that their smartphones help them with their lessons in class and the school's learning environment in many ways. Students stated that they can learn a lot by using their smartphones in class to efficiently look up information about topics related to the lessons. Having a reliable connection to the Internet via their smartphones, students stated that they have real-time access to a wealth of information from various resources on any topic. Sung et al. (2016) and Park (2011) both agreed that mobile technology is readily available with students, so students can look up information to independently help them with their lessons while in school. Students expressed that when they are struggling with specific

topics or literature in class, they can use their smartphones to independently get help online without having to wait on the teacher. They can conduct research on their smartphones in class easier and faster than going to the school library. As Chambers and Sprecher (1980) noted in their study examined in the literature review, in the early adoption of technology in the K-12 classrooms, technology was either used to supplement learning situations and lessons, or it was use as a substitute or a stand-alone method of delivering the lessons. Students were actively involved in the learning process and can learn at their own pace, similar to what is happening today on how students are using their smartphones in schools with or without mobile phone ban policies.

Students wrote about using their smartphones to take notes in class, to access computer applications to help with their assignments, and to access online books and articles needed for class. Some students find it more convenient and quicker to use their smartphone than Chromebooks and laptop computers. So, students are using various types of applications on their smartphones for learning in the classroom. AlTameemy (2016) and Ott et al. (2017) mentioned how there are a growing number of mobile applications being developed for educational purposes. Computer applications and tutorial videos today in which students want to use on their smartphone technology have the same educational intention as Chambers & Sprecher (1980) wrote about for the first computer assisted instruction technology developed on Stanford University's campus back in the early 1960's. That is to increase the skills of the content in their math and language classes. School districts are beginning to acknowledge this, as seen as part of their mobile phone policy changes, the School Board of Broward County, Florida (2019), adheres to the belief that

technology should play a vital role in meeting the needs of the broad range of abilities, disabilities, cultural backgrounds and ethnic populations represented in districts schools.

Some students expressed that smartphones actually help them concentrate and focus better in class. And smartphones can help some students be more interested in the lessons. Others felt that smartphone use can help students be more engaged and want to participate more in class. This is aligned with the earlier adoption of technology in K-12 schools that aim to actively involve students in the learning process in the classroom, to provide opportunities for students to work in their own pace, and to provide interventions for English learners and disadvantage students (Chambers & Sprecher, 1980; Bitzer, 1973). Because smartphones have firmly established within student lives, smartphones have become a familiar tool that students are more likely to gravitate to in any setting. In Kalloo and Mohan (2011), a variety of mobile learning applications such as text-based lessons, tutorials, games, collaborations, and personalized recommendations were used to give students a choice in how they acquire knowledge for learning. Furthermore, Thomas and Munoz (2016) found in their study that learning can take place anywhere anytime to mobile technology where teachers not only can personalize instruction but also students can self-regulate their own learning. The difference today is that students do not have to wait for teachers to give them access to computer applications or wait for guidance on which one to use for class. Students mentioned that they have direct access to many learning applications and videos with their smartphone technology that can support their learning. However, current research shows that the use of cell phones in education is driven by teachers to primarily stimulate motivation, strengthen engagement, and deliver content, not for constructive thinking or reflection (Sung

et al., 2016). More dialogue needed between students, teachers and curriculum providers to develop ways smartphones can be used for constructive thinking and reflection.

Although early studies by Chambers and Sprecher (1980) predicted a widespread acceptance of technology in the classroom when cost decrease and technology improved, schools are adopting the use of Chromebook technology, but not students' personal smartphone technology. School administrative and teachers are still reluctant to allow students to use their smartphones in schools even though the technology being used is at no cost to the school and is more portable and preferred by students. Teacher reluctance is similar to one of the major findings with computer assistance instruction technology that Chambers and Sprecher (1980) noted as the three disadvantages of using computer assisted technology, that is, the need for teachers to change their accepted instructional methods to a new and relatively unproven method of teaching with technology. Because smartphone technology is yet to be proven to be effective for student learning, schools are reluctant to allow its use.

Smartphone Use to Ease Anxiety

Although students indicated they rarely get in trouble for using their smartphone in class and that there are inconsistent expectations about mobile phone use in school, teachers are still constantly telling students to put away their smartphones or to get off of their smartphones. As a result, students feel nagged about their smartphones use and feel that teachers and administrators just do not understand or care why students use their smartphones. Students shared that smartphones help ease the anxiety that some students have in school. Some students used their smartphones to help them get through their work by listening to music or watching videos. Also, students shared that, during time at school,

they may need their smartphones for mental breaks from the demands of the classwork. One student went as far as to write that their smartphones help keeps them sane. Students' statements in this study are quite different from the concerns found in earlier studies on the perception of mobile use in schools. Maphalala & Nzama (2014) found that teacher, parents, and even students expressed concerns that students are addicted to mobile phones and the time spent on social media will result in higher failure rate in school. Spitzer (2015) further claimed that mobile phones cause addiction, attention deficits, impaired learning, depression, and personality disorder. Now, it appears with the ease of access to many applications, some students are finding mental relief, emotional support, and coping strategies with smartphone use in schools. In the literature review of a youth mobile lifestyle study by Vanden-Abeele (2014), the study found the more mature youth seek more pragmatic gratifications from their mobile phones, and younger youth depended on the features of their mobile phones because they struggled with their emotions and were more concerned about fitting in. Again, with the increased capability of today's smartphone technology and the vast number of online applications available, students are using smartphones for self-therapeutic purposes as well as for entertainment and social connections.

Furthermore, the indications mentioned by students in this study to have the choice of when and how to use their smartphones in schools but not being able to, correlates to Scherer and Siddiq (2019) views that technologies policies are not providing students equitable opportunities to perform well in school. Scherer and Siddiq (2019) points out that inequalities persist with respect to technology use and student performance outcomes based on which technology students prefer to use and how students are using their technology. In other words, give students the opportunity to use whatever technology they are comfortable

with to engage with learning. However, this does not address one point some students indicated, that is, they use their smartphones for entertainment when they are bored or have completed their work. Which speaks to a larger question concerning the learning expectations and lesson activities planned by teachers. Tobias (1973) suggested in an earlier study related to the use of computer-assisted technology in classrooms that students' distractions were not the result of their capability to multitask but rather students would pay more attention to the activities they found more motivating and interesting during a lesson.

As school student support teams look to provide wrap-around services for students to address their social-emotional learning needs, the use of technology is far from the list of interventions and strategies to accommodate student needs. In conjunction with calming rooms, counseling services, stress balls, and manipulatives, students in this study have identified the use of smartphone technology as an intervention to relieve anxiety in school as well.

Smartphone Use to Stay Connected with Others

Besides having their smartphone in school as a safety measure and a sense of security, students feel that it is important to have their smartphones help them to stay connected with other people and events. Yan (2018) and Vanden-Abeele (2014) share similar views in their findings that smartphones have become the primary way students communicate with others for both personal and school-related activities. While in class, students indicated that they use their smartphones to connect with class materials for the lessons. Students use their smartphones to connect with their classmates and teachers about assignments needed for lessons and school activities. Student athletes receive notifications from their coaches, concerning practices and games. When students are absent from school,

students use their smartphone to connect to the lessons, assignments, and make-up work to keep from falling further behind. Furthermore, students want to stay connected to their families not just in case of emergencies but also for personal reasons as well. Families are no longer contacting the school's main office to communicate with their child, they are contacting the child's smartphone to communicate directly to them. Whether it is for early dismissal, a doctor's appointment, or to pick up a sibling from their school, families are contacting students while they are in school. I have experienced some family members becoming angry at the school if they are unable to reach their child on their smartphone.

Vanden-Abeele (2014) found similar reasons amongst the top eight gratifications students got from their mobile phone use. Some of the reasons included students' ability to stay connected with family and friends, having their mobile phone in case of emergencies, able to discuss and arrange schoolwork, and to pass time. And, this constant connection to family, friends, classmates and society is what Vanden-Abeele stated that gives students a method to reflect and react to the structural positions that students are faced with.

Gonzales et al. (2020) and Shoemaker et al. (2004) mention that having their smartphones with them in school, students can depend less on the school and the district on providing up-to-date and reliable personal computing devices to connect to the Internet for class. However, due to video streaming volume schools are experiencing on their network bandwidth, I notice that IT departments in districts are limiting personal device access on the schools' network. Students are only able to access the school Wi-Fi connections via school-owned mobile devices such as Chromebooks. This action is only frustrating students more because they feel school leaders do not really care about them or about what they go through during school to know why staying connected on their smartphones is important.

With the students' desire to stay connected with their families and their classrooms utilizing their personal smartphone technology, schools can show their support by adopting Rowsell et al. (2017) approach to confronting the digital divide. First, schools should not give up on advocating for equitable distribution of digital resources in schools, which includes funding to support teachers in providing relevant and meaningful instruction in using technology and making sure there is consistent access to technology for all students. Students acknowledge this with the readily availability of Chromebooks, however smartphone use is being frowned upon. Secondly, we must fund out-of-school programs to support families in increasing their knowledge in using technology for educational purposes. Students are finding applications on their own using their smartphones. Instead of considering smartphone use just for families' emergencies during school, intentionality has to be placed on the benefits and opportunities of smartphone use for learning. Thirdly, schools should use technology for critical and cognitively demanding activities in schools for student learning instead of just using the technology. Again, with the portability, connectivity, and computing power, smartphone use can help students accomplish this. And lastly, research and practices should be shared in collaboration with teachers and parents to provide robust digital teaching and learning for students.

Smartphone Use is Essential to Life

Today's urban high school students are a part of the digital youth generation (Castells et al., 2007; Campbell & Park, 2008; Axelsson, 2010; Ling & Bertel, 2013; Ito, 2005; Ling & Yttri, 2006; Ling, 2004; Caronia & Caron, 2004). From birth, students have been exposed to and using technology in their lives everyday (Prensky, 2001). Students have stated that smartphone technology has become a part of their lives and is essential to getting things done

faster and more efficient. Yan (2018) and Vanden-Abeele (2014) find similar perspectives in their studies as well. Also, students mentioned that technology will soon take over in education. With the increase availability of online education applications, curriculum material and lesson videos, students are increasingly using their smartphones to access textbooks, science lab simulations, literacy and writing tools, and research resources. This is consistent with what Park (2011) refers to as ubiquitous learning (u-learning), where mobile technology is essentially there with students in the background anywhere anytime for their use. Students continue to confirm that smartphone technology is a part of their daily life. And, I agree with Scott et al. (2015) that technology use, technology education, and technology accessibility are viable tools for all students, especially within today digital youth society. However, teachers and students must discuss their perspectives on smartphone use in classrooms since one sees the technology as a distraction while the other sees smartphones as a useful technology for learning. Preston et al. (2015) sees this dialogue as a way to examine the power dynamics of the two views; where one can see mobile phones use as a form of liberation, while the other may see it as class dominance. Students mentioned that if allowed they would use their smartphones for lessons in the classrooms most of the time, but rarely do teachers purposely have lessons planned where smartphone technology is embedded within the lessons. So, like Sung et al. (2016), I believe that the actual impact on students' performance can only be determined when the curriculum and planned lessons are closely integrated with smartphone technology. With this change, schools may see similar results shown in Engel and Green (2011) pilot study that showed increased student performance and engagement when mobile phones were purposely planned in a lesson.

Technology is constantly evolving and the user's experience with smartphones is taking on new applications more frequently since the adaption of mobile phones. With this, students are creating new standards for communication, accessing information, and socializing with their smartphones (Yan, 2018; Lauricella et al., 2014; Rogoff, 2003; Vygotsky, 1978). Schools are now grappling with how Artificial Intelligence (AI) software applications will impact students' submission of assignments. And while school officials are requesting the need for more monitoring, content blocking, and scan for plagiarism computer applications, students are talking about the benefits and the many possibilities for opportunities to enhance their learning experiences with technology. Students see smartphones as a productive tool that gives them a sense of freedom. Students' smartphone use is not defined by space or time, whether they are in school or not, because their smartphone is with them all the time, a similar perspective found by Anderson & Jiang (2018) in their study. As one student wrote in this study, "Tech is life."

Implications of the Findings

This study's purpose was to elevate the perspectives and beliefs of urban high school students concerning the use of smartphone technology in school. There were minimal statistical differences amongst male and female students concerning the use of smartphones for remote learning and for connection to school related activities, and between students with disabilities and those without disabilities that would use their smartphones in class if allowed by the teacher. The most important revelation of the study is that the statistical analysis of the quantitative data and the analysis of the open-response questions revealed counternarratives to the dominant narratives and results found in the limited current literature on smartphone technology use in high schools. Earlier studies on smartphone technology in

education focused on distractions, negative academic effects, and problematic social issues students were experiencing (Ariel & Elishar-Malka, 2019; Kwok et al., 2017; Preston et al., 2015).

Implications for Theories

In this study, I used the tenets of Culturally Responsive Teaching from the students' perspective instead of the teachers' perspective and dubbed it as Culturally Responsive "Learning" (with Technology). The intent here was to show that high school students are able to reflect, build upon, and make connections on whether smartphone technology use can enhance learning in the education setting. Culturally Responsive Teaching is an instructional strategy that calls for teachers to build upon the assets that students already bring with them to school instead of using a deficit model (Ladson-Billings, 2000; Gay 2010). As the results of this study show, what might be considered as an asset to students may be different from what teachers and school leaders believe, namely smartphone technology.

The majority of earlier literature on mobile phone use in schools, examined from the adult perspective, shows mobile phone technology causes a deficit in student learning and is nothing more than a distraction. Students in this study were able to specifically name how smartphone technology is used in school to support their learning and social emotional needs. Also, Culturally Responsive Teaching calls for teachers to reflect on their instructional practices to determine how their biases, world views, and experiences influence their curriculum use, lesson planning and instruction (Ladson-Billings, 2000; Gay 2010). As digital immigrants, teachers and school leaders may have different views on the essential use of smartphone technology when compared to today's youth who are digital natives (Anh & Jung, 2016; Prensky, 2001). Student participants in this study were able to reflect on

smartphone technology use and indicate how essential mobile technology is for today's youth not only from social perspectives, but also in school.

Lastly, Culturally Responsive Teaching calls for teachers to build lesson that connect to students' identities to support their personal growth and sociopolitical consciousness (Ladson-Billings, 2000; Gay 2010). Because schools are lagging behind in purposefully creating opportunities to embed smartphone technology in the classrooms to fulfill this goal, the results in this study shows that students are proactively findings ways to effectively utilize their smartphones in school, despite existing policies and despite the inability of teachers to do so. This study shows that more empirical and participatory research with high school students is needed under the lens of Culturally Responsive Learning with smartphone technology.

Implications for Practice

Based on the finding of this study, I urge teachers and school leaders to set aside their reluctance to adopt smartphone technology use in school, and to purposely create ways with students to realize the benefits. When students were asked about the usefulness of smartphones in school, across all demographics, students agreed that smartphones are useful in school, in their classrooms, and during remote learning. Students agreed that smartphone technology can help them with their lessons and help them get better grades in their classes. And students indicated that their smartphones were used most of the time to keep them connected to school during remote learning. When students were asked about their beliefs and understanding of mobile phone policies in school, students acknowledged that they understood the school's mobile phone policies but believed that they should not be getting in trouble for using their smartphone in school. And the majority of the students in the study

neither agreed or disagreed that smartphones are a distraction to them or their teachers, but really felt that smartphone technology is a useful tool to have in school. There has to be a balance between the expectations of smartphone use in school for learning and the protection of potential danger against online bullying, posting of fights, and academic dishonesty (Charles, 2012). When students were asked about smartphones being used to connect to school, their families, and their friends, students agreed that smartphones were used while in school to stay connected to their families and their friends. Although students disagreed that smartphones made them feel more connected to school, the results further showed that students found smartphones were used to stay connected with class notifications, their assignments, and school activities.

The most revealing aspects from the study are the written statements for the open-response questions that smartphone use in school is important for student as a sense of security, that smartphone use in school ease students' anxiety, and that students are open to having dialogues with school officials about the important of smartphone use in their lives. Current literature acknowledges that mobile phone use in schools is desired by families and students in case of emergencies. However, this study reveals that students also feel of sense of safety and security when they have their smartphone with them. Students indicated they can use their smartphones to stay abreast of what is happening in school and to inform others outside of school what is happening inside the school. Secondly, the students indicated that smartphones help ease the anxiety for some students. Students are able to listen to music on their smartphones without disturbing others as they complete their assignments in class. Students are able to entertain themselves on their smartphones when they need mental breaks from the classwork. And lastly, students mentioned that they are open to having further

discussions with school leaders and teachers about why smartphone use is important and essential in their lives during school. Which shows that school leaders and teachers are still at odds with students on how smartphones can be utilized in schools (Selwyn & Bulfin, 2016; Peck et al., 2015). Students stated that if principals and teachers really cared about them, then they would want to understand why students used their smartphones so much.

Now that Black and Brown students in urban schools have reliable, constant access to technology and the internet with their smartphones, learning experiences can be enhanced in real-time, both in the classrooms and at home. But in order for students to benefit from smartphone use and to capitalize on the educational opportunities with portable technology, teachers, administrators, school officials, and policy-makers should be willing to reimagine smartphone technology within schools to further decrease the digital divide and digital inequalities. By intentionally embedding smartphone technology in educational practices, Black and Brown students, specifically those in lower social-economical neighborhoods can have access to and learn how to use resources that increase their human and social capital. Oftentimes, Black and Brown urban students lack access to the instructional expertise and lesson activities or curriculums that develop their cognitive skills for today's knowledge-based economy (Watkins et al., 2018). However, with intentional use and training of their smartphone technology for educational purpose, this challenge can be addressed.

Social workers and school counselors should take the lead in working with students to understand how smartphones can further assist with social-emotional learning and to reduce students' anxiety levels while in school. In this study, students mentioned listening to music while completing assignments and using their smartphone during lesson breaks. These activities and using specific smartphone applications should be identified as Tier 1

Interventions and incorporated within students' individualized educational plans when appropriate. Having students self-identify academic and behavior interventions using their smartphone technology can increase achievement rates.

Implications for Policy

The results of this study shows that students believe that there are benefits to smartphone technology use in schools. Although there are still concerns of inappropriate use of social media and of mobile technology application distractions, students indicated that smartphone technology ban policies are not necessary and may go against some essential purposes of their use. As educators, school leaders, education policy makers, and curriculum providers, we have to collaborate with students in developing smartphone technology use policies that reflect the needs of today's youth and their technology culture. Schools and districts should develop policies on smartphone technology use in curriculums, assessments, and lesson plans that focus on student positive outcomes and academic performance growth.

Moreover, smartphone technology use policy should not just focus on content delivery, information research, and student engagement but also include use for constructive thinking, reflection, and simulations. This is possible because smartphone technology has real-time communication capabilities and individualized interfaces (Sung et al, 2016). From a wrap-around student support perspective, smartphone technology use policy in school should include support for students' social-emotional well-being and overall mental health wellness as well. In addition, intentionality related to teaching students about the appropriate use of smartphones should be included in school policies across all age groups. Appropriate smartphone technology use policies for academic integrity (given the rise of Artificial

Intelligence applications), for social media bullying and for distribution of inappropriate material are still needed. Updates on these policies can be co-developed with students.

Black and Brown students in urban schools should stop being criminalized and ostracized for using their smartphone technology in schools. Furthermore, how they choose to use their smartphones should not be controlled by teachers and school administrators. This by no means mean that there should not be consequences for students who use any technology or online platform inappropriately, but rather creative spaces and opportunities to use smartphone technology for learning should be made available. And as Watkins et al. (2018) points out, Black and Brown students have opposition to authority and disciplinary actions that seems to target them for utilizing their sources of cultural capital. So, it does not make sense for schools to have mobile phone policies that seems out of touch with today's digital youth generation and for teachers to constantly ask them to put away their technology of choice, i.e., their smartphones.

In addition, teacher's evaluation rubrics and instructional practices should have a technology-specific standard. Teachers' performance levels are usually measured by how well they plan lessons, by instructional moves and classroom management, by family engagement, and by professional collaboration. The use of technology is often nested within lesson planning and instructions. By deliberately separating out technology use as its own teaching evaluation standard, this could highlight the importance of using technology in the classroom with this digital generation and increase the use of smartphone technology for educational purposes.

Prior to deploying one-to-one strategies that provided every student with Chromebook technology in school and before smartphones were widely adopted by students,

several school districts enacted a “bring your own technology to school” policy. Schools encouraged students to bring their technology to school to use in classes, however only families who could afford the portable technology were able to do so. And, school officials at that time had full control of how students connected to the Internet and were aware of the very few computer applications. Today, youth across all socioeconomical family status have their smartphones with them all the time and are mostly connected to the Internet independently of school’s communication network. Furthermore, many computer applications are widely available for use. Instead of building upon the “bring your own technology to school” model, school districts begin banning the portable technology most families owned, the mobile phone. Students constant use of smartphone technology show the need to reconsider policies that ban mobile phone use in schools.

Furthermore, teacher preparation programs, specifically those focusing on urban education for Black and Brown students, should require classes that build capacity related to using smartphone or portable technology in the classroom and for assignments. High school teacher candidates should be required to develop lesson plans and relevant projects with cognitive demanding tasks that utilize smartphone technology. Lesson activities should focus less on foundational skills, and more on transformational skills, such as cognitive and creative thinking (Tyner, 1998). By increasing Black and Brown urban students use of technology for cognitive demanding tasks, their academic performance will increase (Robinson et al., 2018). More importantly, their overall digital experiences will enhance learning outcomes and critical-thinking skills.

Discussion for Implications

The majority of existing studies focus on how mobile phones are nothing more than a distraction for students in school (Maphalala & Nzama, 2014). Insomuch that school mobile phone technology policies developed by school leaders, administrator and policymakers are focused on banning mobile phone use in schools altogether. There are limited studies that actually focus on how urban high school students are utilizing mobile technology to support their education (Kates et al., 2018; Spitzer, 2015; Sung et al., 2016). The findings in this study challenges those dominant narratives that mobile phones are not useful to students in school and youth are just addicted to them. Students were able to provide insight on how they are using smartphone in school to assist them in completing assignments and to understand the content. Also, students provided recommendations to teachers and school leaders about mobile phone use in school such as to incorporate smartphone use in more lessons and to just allow students to use their smartphone in school because it is not big deal.

Several studies show that students' academic performances are lowered when students are using their mobile phones in school (Duncan et al., 2012; Froese et al., 2012; Kates et al., 2018; McDonald, 2013; Ellis et al., 2010). Although that may be the case if students are spending more time off-task than grasping the concepts of the lessons, but what these studies fail to realize is that technology is constantly evolving and there has not been an intentional concerted effort to integrate mobile phone technology within the educational system. Also, students tend to navigate to activities in class that captures their interest the most even when sitting in class. What students are saying in this study is that incorporating smartphone technology in lessons may make engaging in the lesson more interesting and that they actually can receive better grades when using their smartphones for online applications

to help them with assignments. And, at times, using the smartphone in class is more efficient than waiting on their teachers for help. Multilingual students and students with disabilities are benefiting as well when their teachers do not speak their first language or are unable to contextualize key concepts in the lessons.

Bullying, distraction, sexting, and addiction have been the main focus of mobile phone technology studies during the early adoption of the technology by youths (Preston et al., 2015; Maphalala & Nzama, 2014; Spitzer, 2015). However, this focus should shift to one that looks at the relevancy and practicality of mobile phone usage by youth. Because as the end-user monthly costs for smartphones became more affordable and communication companies adopted other revenue streams from online advertisements, over 95% of today's youth have access to a smartphone (Pew Research Center, 2018; Andersen & Jiang, 2018). Smartphones, along with other portable electronic devices such as web tablets, smart watches, notebook computers, and electronic games, have enabled a digital youth culture that is formed from birth. And for students, schools should not have any smartphone use boundaries or restrictions. Researchers and school leaders should work with students on how to best integrate smartphone technology in education so teachers are not wasting teaching and learning time asking students to put away their smartphones.

Also, students in this study stated two smartphone usages while in school that are not classified as a distraction or an addiction; smartphones help relieve anxiety and smartphone helps them feel safer. Students listen to music on their smartphones while completing their assignments or watch video during learning breaks to help relieve their anxiety in school. While social-emotional counseling is available in schools, counselors may have large caseloads that students do not always get to see their counselor every moment they want to,

so smartphones are being used as self-therapeutical tool. In addition, students no longer believe that school leaders can keep them safe from school violence or will inform them in a timely manner when there is danger within or around the school. Having their smartphone with them at all time allow them to communicate with others in case of school violence or to receive early enough warning to be able to move to a safe location. Smartphones give students that sense of security.

As we look at reform initiatives for urban high schools specifically related to technology usage, school leaders have to stop criminalizing students for using their smartphones. As culturally responsive educators, we have to look at youth smartphones as an asset not a deficit (Ladson-Billings, 2000; Gay, 2010). This is the first step to begin successfully implementing smartphone technology in education to increase students' academic outcomes and to improve Black and Brown students' social capital in society. Smartphone technology coupled with online computer applications is well positioned to assist in further narrowing the digital divide and addressing digital inequalities for Black and Brown families.

Limitations of the Study

The first limitation of this research study is my belief that technological innovations can advance individuals' quality of life and my experience with working with mobile phone technology within two Fortune 500 companies. Since growing up I have always been intrigued by technology and how personal technology can provide support, convenience, and benefits to individuals. Later, I have worked with companies and engineers in defining technical requirements for mobile phone technology applications and features. As a teacher, I constantly seek ways to utilize technology in my classrooms to enhance students' learning

experiences and to provide academic interventions for my students. I have worked to minimized the impact of my technology biases throughout this research study through reflexivity.

The second limitation includes the sampling methodology of this study. I sent an email invitation to participate in the study to every student by grade-level in both schools. The number of students who are classified with learning disabilities who responded was not closely reflective of the schools' reported percentages of students with learning disabilities. Also, both schools selected for the study general populations were mostly of the Black/African-American and Hispanic/Latinx race demographics. Number of participants in the study who classified as Asian/Pacific Islander, Native American/American Indian, Mixed or Not Listed was significantly less than Black/African and Hispanic/LatinX or none. The generalization of the results may not be reflective of these student populations.

Next, because the invitation to participate in the study was sent via students' emails and announcements about the study were made in classes, students decided on their own whether to participate or not. This may have caused self-selection bias in the results due to students who decided to participate in study may have been students who really cared about having smartphone use in school. Other contextual factors that may have contributed to survey responses and drop-off rates include the dynamics of the class settings, the timeframe within the class period and the distraction of other activities happening in school during the time the participants completed the survey.

In addition, the study was conducted through a descriptive method using a survey without a control group in one urban school district, so the generation may not reflect school districts around the nation. The survey answers were self-reported by high school students

who were to give a thoughtful answer about their experiences with using smartphones in school. There were no in-school or in-district reports available or used to verify or cross tabulate their responses. Also, due to COVID-19 restrictions during the time of the study, the study was limited to quantitative research only. A mixed study with student focus groups was desired to affirm students' survey responses. However, the open-response questions were added to provide an alternative opportunity for the participants to express their beliefs.

Using a quantitative research methodology, the results of this study may have experienced response and confirmation biases as well. Participants were high school students who often deal with peer pressure and a wanting to belong in a group. The participants response to the survey instrument may have been influenced by their peers since most surveys were completed in school. Also, if students complete the survey while in a school setting, there is increased chance of acquiescence and conformity biases given the self-reporting nature of the Likert-scale survey and the open-response questions. Because most students completed the survey on their personal smartphones even while in a school setting, I believe that students openly and honestly answered the survey and the open-response questions. When examining the written responses to the open-response questions, although the students' written answers were similar in nature, I found a very limited number answered with exact wording, thus, reflecting students' own personal beliefs.

And lastly, as an administrator and former classroom teacher working in an urban high school environment, I often interact with students who are using their smartphones in school; some students using their smartphones for productive use and others who used them inappropriately. The creation of the survey instrument and the analysis of the participants responses may have been influenced by my personal work experiences in the high school

setting. However, to minimize these biases I used appropriate statistical tests, use clear and neutral non-leading questions, and compared the results of the Likert-scale type questions with the open-response questions responses by the participants.

Recommendations

Recommendations for Smartphone Use in Schools

Across the nation, organizations are focusing on redefining their culture and climate around Diversity, Equity, Inclusion, and Belonging (DEIB) practices. School systems have adopted this organizational concept for both their teaching and learning practices with students and their staff development. Districts, school leaders, and teachers can relate this same practice for smartphone use technology in schools. There is a diverse set of personal computing devices available that students can use, such as laptops, Chromebooks, web tablets, and smartphones. Depending on their families' social economic status and preference, schools can allow students to bring and utilize their technology of choice in school; the most common technology selected, may very well be their smartphones. Thus, students will bring with them their smartphone as an asset on which teachers can build a modernized, updated curriculum (Scott et al., 2015). Just as with other technology, school districts can implement appropriate use policies and expectations without banning smartphone use, but encouraging it. As students indicated as their top recommendation to school principals and administrators in this study, I recommend that schools eliminate ban smartphone use policies in schools and to acknowledge ways students can utilize smartphone technology for learning as well as how teachers can utilize smartphone technology in instruction.

As school officials aim to provide an equitable education for all students, school leaders and teacher should recognize that there are technology and computer applications more suitable to some students for their academic success than others (Harris et al., 2017; Gonzales et al., 2020). For example, our multilingual students can benefit by having their smartphones readily available with them in their classes for translations and pronunciations as they acquire the English language, and students who are struggling with math can use computer applications for more practice (Chambers & Sprecher, 1980). Some students can use their smartphones in real-time as they are reading complex texts to search online resources that help them understand the context of word and phrases, they may be unfamiliar with. Other students can more efficiently use their smartphone in class to connect with videos, illustrations, and graphic organizers for academic intervention and accommodations. As one of the top recommendations to teachers that students indicated in this study, I recommend that teachers regularly develop unit and lessons plans that utilized smartphone technology. Not only just for basic skill practice exercises and search for informational, but also for simulations and cognitive demanding tasks to strengthen students critical-thinking and collaboration.

In terms of inclusion, teachers can implement smartphone use within their unit and lesson plans to further engage their students and access more relevant up-to-date material. Smartphone technology applications can be used to simulate labs, capture and analyze data, and record observations for projects inside and outside of the classroom. Smartphones can also be used for students to record written, audio, and video notes for lessons which will be available for students to review anytime anywhere (Park, 2011). Students wants to feel safe and have a sense of belonging when they are attending school. And because mobile

technology is an intimate part of their generation, allowing them to have their smartphones with them all the time in school gives them that sense of belonging. Education policy makers, district and school leaders, and teachers should be willing to set aside their personal biases and negative connotations regarding smartphone use in schools and continue the dialogue with students on how smartphones can be embedded in education (Perk et al., 2015). I recommend that school staff and policy makers begin to look at smartphone technology as an asset to students' learning experiences rather than a deficit.

Recommendations for Future Research

It is interesting to see how mobile technology such as smartphones is rapidly being implemented in various higher education programs and in remote areas around the world (Peck et al., 2015; Pedro et al., 2018). However, for smartphone adoption in K-12 schools, reluctance on the part of school leaders and teachers is still prevalent (Peck et al., 2015). This study aims to join the limited empirical research that focuses on the perspectives and beliefs of smartphone implementation in schools by high school students. Additionally, the study aims to uncover how mobile phone policies in schools are perceived by and affect students.

The study was implemented with two urban high schools that can be expanded to include more urban high school across the nation. In addition, this study invited students to participate by using email invitation where students were asked to participate. To minimize self-selection bias, a randomized study should be conducted across different urban schools to confirm the generalization of the results from this study. Also, while the focus was on Black and Brown students in an urban school district, including suburban schools will increase the

number of participants in the different race/ethnicity demographic for further comparison and a broader context.

Next, the number of students who are classified as students with disabilities in this report was not reflective the student population. To ensure that students with disabilities are well represented in the study, the student's disability status should be used as a qualifier for a future study prior to implementation. In addition, the study was conducted within a school setting which may have resulted in response and confirmation bias due to peer pressure. Conducting the study in other places such the mall, the movie theaters, or other places where high students often visit or hang out could offer confirmation of the general results as well.

Finally, although the students' open-response written remarks provided clarifying and expanded views on their Likert scale responses, a mixed study with students focus groups would have been helpful to affirm, verify, and further clarify the quantitative results found in the study. Student focus groups were not possible due to IRB restrictions during the time of the COVID-19 pandemic. As a result, a post-graduate qualitative research study is planned that will include student focus groups.

Conclusion

Today's students are part of the digital generation, a digital culture where smartphone technology is an intimate part of their lives every day. From ordering food to arranging transportation, from keeping track of social activities to planning time to meet together, and from expressing themselves using multimedia applications to having a digital technology companion for music, a sense of security, and a way to connect with others anytime, smartphones are with today's youth and are used all the time. Yet, urban schools' administrators and school leaders still consider smartphone technology as a distraction in

schools and have not consider the benefits of using smartphones as a ubiquitous-learning (u-learning) tool.

As school leaders and teachers, we have both the opportunity and responsibility to reshape the dialogue, professional development, curriculum lesson plans, teaching and learning classroom activities, school culture, and climate and family connections to disrupt and dismantle the dominant narrative on smartphone technology use in schools. Using the students' perspectives, this study has deepened my understanding on how smartphone technology can further be used to help shape students' academic and personal success. Based on the findings, it is important to involve students, their families, and education policy makers in the discussions regarding decisions about smartphone use and the technology inequities in our schools. These decisions and our actions as school officials affect students the most. Adopting smartphone technology use in our high school is potentially one of the most impactful social justice tools for providing culturally responsive teaching for all students.

In order to achieve this, there has to be an intentional paradigm shift in both the philosophy and practice from the traditional teacher-centered instructional mind-set to an adaptive student-centered approach which embeds not only students' multiple learning styles in teaching and instruction, but also the use of their smartphone digital technology and applications. Technology policies that are full of rules, regulations, and controlling aspect have to be replaced with personalized, individualized and student-led strategies to engage and support today's students' academic achievements in schools. Teachers in urban schools are wasting too much instructional time trying unsuccessfully to enforce outdated mobile phone policies instead of collaborating in professional development to figure out how to use

smartphone technology to enhance students' educational experiences. Furthermore, these learning experiences can be codevelop and cocreated with the students.

Smartphone technology use by students can serve as a modern equalizer to actually reduce the digital divide and digital inequalities for Black and Brown students. Where having just mere access to technology and having connection to the internet are no longer the gating challenges for the digital divide, how technology is used and for what purpose technology is being used for by students define the digital gap in today's social eco system. Smartphone technology provides opportunities for urban Black and Brown students to gain access to both social-economical and educational capital within and outside of their neighborhoods. Explained by the digital edge philosophy, how Black and Brown students currently use their smartphone technology is influenced by institutional and societal practices.

Even with ban mobile phone policies in schools and constant reminders to put away the smartphone in class, urban high school students are still finding ways to use their smartphones to complete assignments, access online tutorials, stay connected with family members, pass time, and reduce their personal anxiety in school. During remote learning due to COVID-19, majority of students stayed connected to school by their smartphones. Imagine what accelerated educational achievement gains can be made if teachers, school leaders, administrators and policy makers would consider the recommendations of urban high school students to leverage the digital youth culture to reform smartphone technology use for educational purposes.

Urban high school students believe that ban mobile phones are outdated and are irrelevant for today's youth. Not only that, the ban mobile phone policies are difficult to

enforce anyway so the expectation of smartphone technology use across the school is inconsistent or just does not make sense. Acknowledging that there are risk inappropriate use of smartphones like social media drama or online bullying, and rare interruptions in classes due to ringing or sounds from smartphones from students who did not have the device on vibrate, urban high school students state that students should still should just be allowed to use their smartphones in school, it is no big deal. And this perception was similar across students' racial/ethnical backgrounds, gender identities, grade levels, and with students with disabilities.

This research study adds to the literature on whether smartphone technology is useful in high schools and the effects the technology can have on students' performance. Educators should work on creating an identity-conscious school around technology use with students, parents, and community leaders. The study revealed that students find smartphones useful both inside and outside of school. Students want school leaders and teachers to understand that smartphones are essential to their lives and have many benefits. These benefits include helping them with assignments, having efficient access to the Internet to help with research topics, and to independently finding more information about topics they are struggling with in class, and having the ability to communicate during school hours with teachers and family members. In addition, smartphones technology can help students with their anxiety and can give students a sense of security while attending school.

APPENDIX A: UMASS IRB APPROVAL LETTER

UMASS BOSTON
UNIVERSITY OF MASSACHUSETTS BOSTON
INSTITUTIONAL REVIEW BOARD

100 Morrissey Boulevard
Boston, MA 02125-3393
P: 617.287.5374
F: 617.287.5396
www.umb.edu/orsp

January 24, 2022

Artis C. Street, MEd, MBA, MS
Leadership in Education

IRB Study Number:	2022006
Title of Protocol:	Smartphones Use In Education: The Students' Perspective
Type of Review:	Expedited
IRB Approval Date:	1/24/2022
IRB Expiration Date:	**None; however modification and closure submissions are required (see below)**

This protocol has been reviewed and approved by the University of Massachusetts Boston IRB, Assurance # FWA00004634. The IRB determined that the research presents no greater than minimal risk to children (45 CFR 46.404). There are adequate provisions for assent (45 CFR 46.408) and the permission of the parents (45 CFR 46.408).

This protocol does not require continuing review. When the research meets the criteria for study closure, you are to submit a completed Final Report form to the IRB.

As Principal Investigator you are responsible for the following:

1. Following the requirements listed in the INVESTIGATOR MANUAL (HRP-103).
2. Submission in writing of any and all changes to this project (e.g., protocol, recruitment materials, consent form, staff changes, etc.) to the IRB for review and approval prior to initiation of the change(s).
3. Reporting any of the information items listed in the INVESTIGATOR MANUAL (HRP-103) (including unanticipated problems involving risks to subjects or others or non-compliance with the regulations or the requirements or determinations of the IRB) within five business days.
4. Use of only IRB approved copies of the consent form(s), questionnaire(s), letter(s), advertisement(s), etc. in your research. It is no longer necessary to have recruitment materials or consent forms stamped by the IRB.
5. Ensuring that all study staff who are engaged in research involving human subjects have a current completed human research (CITI) training prior to conducting and for the duration of their engagement in this project.
6. Submission of a final report upon completion of this project.

The IRB can terminate projects that are not in compliance with these requirements. Contact (617-287-5374) or email (irb@umb.edu) if you have any questions or require further information.

Sincerely,

Sharon Wang, CIP, CIM
IRB Manager, University of Massachusetts Boston

APPENDIX B: BOSTON PUBLIC SCHOOLS IRB APPROVAL LETTER

Office of Data and Accountability
Monica Hogan, Senior Executive Director
Bruce C. Bolling Municipal Building
2300 Washington Street
Roxbury, Massachusetts 02119 617-635-9450
research@bostonpublicschools.org
bostonpublicschools.org

4/21/2022
Artis C Street
University of Massachusetts Boston

Dear Artis C Street,

I am in receipt of your research proposal entitled *RA-196: "Smartphone Technology Use in Education: The Student Perspective ."* **Your research application has been approved.**

If your study involves primary data collection at a school site, your next step is to complete the CORI application for each researcher who intends to collect primary data with students. CORI applications can be submitted at www.bostonpublicschools.org/cori. Additional details for submitting a CORI review can be found here. For virtual observations, please select "Office of Data and Accountability" as the volunteer location.

If your study requires an administrative data request, your next step is to submit a Non-Disclosure Agreement Request Form to request a new NDA or to renew a previous NDA. Once your request is received, our ODA team will work with you to execute a non-disclosure agreement with mutually agreed upon administrative data elements. NDAs must be renewed annually.

Enclosed you will find a copy of the Research Proposal Review Form, which must be completed by a school leader if you are intending to do primary research within a school. It is your responsibility to have this form signed by the leader of each school in which you plan to conduct research. Please share a copy of your executive summary (max. of 1 page) along with this Review Form with each intended school site. Approval for this study in each school is contingent upon your returning the signed review forms to the Office of Data and Accountability via email to research@bostonpublicschools.org.

Your study is approved for one year from the date listed above. If you wish to continue your study longer than one year, you must re-submit your application within 1 year's time.

If you have any questions about this matter, please feel free to contact our office at research@bostonpublicschools.org.

Sincerely,

Monica Hogan
Senior Executive Director
Office of Data & Accountability

APPENDIX C: INFORMED CONSENT FOR (PARENT)

INFORMED CONSENT FORM

University of Massachusetts Boston
Department of Leadership in Education
100 Morrissey Boulevard
Boston, MA 02125-3393

Consent Form for Smartphones Use in Education – Online Survey

Introduction and Contact Information
Your son/daughter is interested in taking part in a research study. **Participation is voluntary.** The researcher is Artis C. Street, Doctoral Candidate at University of Massachusetts Education Leadership Program and an administrator within Boston Public Schools. The faculty advisor is Dr. Wenfan Yan, Professor, Department of Leadership in Education. There is no federal funding sponsor of the study. Please read this form and feel free to ask questions. If you have questions, Artis C. Street will discuss them with you. His telephone number is (857) 246-9320.

Description of the Project:
The purpose of this research is to examine to how smartphone use policies effect the digital divide for Black and Brown high school students. Your child's participation in this study will take 20 minutes. If you decide to participate in this study, your child will be asked to complete a 55-question online survey using their smartphone or a school-based computer at a time convenient for them. The questions are related to how students use their smartphones for school or other purposes. After completing the survey, you child will receive a Dunkin Donut $5 gift card.

Risks or Discomforts:
A risk of participation is a loss of confidentiality. We will do everything we can to protect your son/daughter information. If your child feels uncomfortable when completing the research materials, they may skip any questions or stop participating at any time.

Benefits:
There is no direct benefit to you or your child from participating in this study. Your son/daughter participation may help us learn more about smartphone policies and use in schools.

Confidentiality:
Your son/daughter part in this research is **confidential**. That is, the information gathered for this project will not be published or presented in a way that would allow anyone to identify you or your child. Information gathered for this project will be password protected or stored in a locked file cabinet and only the research team will have access to the data.

The University of Massachusetts Boston Institutional Review Board (IRB) that oversees human research and other representatives of this organization may inspect and copy your information.

UMASS BOSTON

All identifiable information that could directly identify you (e.g., your name) will be removed from the information collected in this study. After we remove all identifiers, the information may also be used for future research or shared with other researchers without additional consent.

Voluntary Participation:
The decision whether or not to take part in this research study is voluntary. If you do decide that your son/daughter may take part in this study, they may end their participation at any time without consequence. If they wish to end their participation, your child should directly inform the researcher or exit the survey. Whatever your child decide will in no way penalize them or involve a loss of benefits to which they are otherwise entitled, and it will not affect their grades or status as a student.

Questions:
You have the right to ask questions about this research before you agree to allow you son/daughter to be in this study and at any time during the study. If you have further questions about this research or if you have a research-related problem, you can reach Artis C. Street at (857) 246-9320 or Dr. Wenfan Yan at 617.287.7601.

If you have any questions or concerns about your child's rights as a research participant, please contact a representative of the Institutional Review Board (IRB), at the University of Massachusetts, Boston, which oversees research involving human participants. The Institutional Review Board may be reached by telephone or e-mail at (617) 287-5374 or at human.subjects@umb.edu.

Signatures:

I HAVE READ THE CONSENT FORM. MY QUESTIONS HAVE BEEN ANSWERED. MY SIGNATURE ON THIS FORM MEANS THAT I CONSENT MY SON/DAUGHTER TO PARTICIPATE IN THIS STUDY.

Signature of Parent/Guardian	Date	Signature of Person Obtaining Consent
Printed Name of Parent/Guardian		Printed Name of Person Obtaining Consent

(For Online Version)
By clicking "OK", you will be agreeing to participate in the research. Please keep a copy of this form for your records or if you need to contact me.

Page **2** of **2**

APPENDIX D: STUDENT ASSENT FORM

ASSENT FORM

STUDENT ASSENT – Smartphones Use in Education Survey

My name is Artis C. Street. I am a student in the Department of Education Leadership at University of Massachusetts, Boston. I would like to invite you to take part in my research study. A research study is a special way to find out about something. I am trying to learn more about how smartphone use policies effect the digital divide for Black and Brown high school students.

If you agree to be in this study, you will be asked to complete an online survey on your smartphone or the school-issued Chromebook. You will be asked to complete a 55-question survey about your smartphone use for school related activities. The questions will take about 20 minutes to answer. Some of the questions will be personal and you can stop at any time. Being a part of this study will help me understand how smartphones are being used in schools.

If you agree to help me, your teacher and your classmates will not know what you have answered. If you decide to be in the study or if you decide to say "no", your choice will not affect your grades or whether people like you.

When I am done with the study, I will write a report about what I found. I won't use your name in the report.

Please talk this over with your parents/guardian before you decide if you want to be in my study. I will also ask your parents/guardian to give their permission for you to be in this study. Even if your parents/guardian say yes you can still say no and decide not to be in the study.

If you don't want to be in this study, you don't have to be in it. Remember, being in a study is up to you and no one will be upset if you don't want to be in it. If you decide to stop after we begin that is okay too. Remember that no one else, not even your parents/guardian will know what you have answered.

You can ask any question that you have about the study. If you have a question later that you didn't think of now, you can call me or ask your parents, teacher or a friend to call me at 857-246-9320.

Signing here means that you have read this paper, or someone read it to you and that you are willing to be in this study. If you don't want to be in this study, don't sign.

_____	_____	_____
Printed Name of Participant	Date	Signature of Participant
_____	_____	_____
Printed Name of Investigator	Date	Signature of Investigator

(For Online Version)

By clicking "OK", you will be agreeing to participate in the research. Please keep a copy of this form for your records or if you need to contact me.

APPENDIX E: QUESTIONNAIRE DESIGN

Smartphones Use in Education: The Students' Perspective
Researcher: Artis C Street (University of Massachusetts/Boston)

Thank you for participating in my research study. This online survey should take approximately 20 minutes to complete. The purpose of this research is to evaluate the use of and the attitude towards smartphone technology for in school and remote learning by urban high school students. Your responses to this questionnaire will be kept confidential.

At the end of this survey, you can provide your personal information if you would like to receive a gift card. Your personal information will be stored separately from your questionnaire responses and kept confidential.

Please contact me at artis.street@umb.edu with any additional questions.

Header	**Section 1: Usefulness of Smartphones for School**					
Sub-Header	**Directions: State to what degree you agree or disagree with the following statements.**					
		1	2	3	4	5
1	Smartphone use can help me get better grades in my subjects.	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
2	Smartphone use can help me understand subject material more.	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
3	Smartphone use makes completing my schoolwork more convenient.	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
4	Smartphone use motivates me to explore subject topics on my own.	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
5	Smartphone use can help with classroom discussions.	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
6	Smartphone use can save time in class.	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
7	Smartphone use can help classes be more interesting.	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
8	Smartphone use motivates me to participate in class.	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
9	Smartphone use can make learning fun in class.	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
10	Smartphone use can allow me to collaborate with others easily in class.	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
11	I would be more actively involved in class if I can use my smartphone.	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
12	Using my smartphone to access books/articles will help me read more in class.	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
13	Smartphone use allows me to collaborate with others easily outside of class.	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

Sub-Header	Directions: State to what degree you often use your smartphone for the following statements.					
		1	2	3	4	5
14	I use online apps on my smartphone to help me with my assignments.	Never	Rarely	Some of the time	Most of the time	All the time
15	During remote learning, I used my smartphone to check my emails for information about school.	Never	Rarely	Some of the time	Most of the time	All the time
16	During remote learning, I used my smartphone to stay connected to my classes.	Never	Rarely	Some of the time	Most of the time	All the time
17	During remote learning, I used my smartphone to complete my assignments.	Never	Rarely	Some of the time	Most of the time	All the time
18	During remote learning, I used my smartphone to attend my classes.	Never	Rarely	Some of the time	Most of the time	All the time
19	During remote learning, I used my smartphone to search for more information online to complete my assignments.	Never	Rarely	Some of the time	Most of the time	All the time

Header	Section 2: Your beliefs and understanding of smartphone policies in school.					
Sub-Header	Directions: State to what degree you agree or disagree with the following statements.					
		1	2	3	4	5
20	Students should NOT be getting in trouble for just using their smartphone in school.	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
21	Smartphone use in school causes a lot of problems.	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
22	Smartphone use in school makes me feel unsafe.	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
23	I feel safer having my smartphone with me in school.	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
24	Smartphone use interferes with my abilities to concentrate in class.	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
25	Having my smartphone in class is a distraction for me.	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
26	Having my smartphone in class is a distraction to other students.	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
27	Having my smartphone in class is a distraction to my teachers.	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
28	I fully understand the smartphone use policy for my school.	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
29	I should be allowed to use my smartphone in school.	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Sub-Header	Directions: State how often you have experienced the following for smartphone use in school.					
		1	2	3	4	5

30	How often do you get in trouble for using your smartphone in class?	Never	Rarely	Some of the time	Most of the time	All the time
31	How often do you see other students getting in trouble for using their smartphone in class?	Never	Rarely	Some of the time	Most of the time	All the time

Header	**Section 3: Smartphones for student enables connections**					
Sub-Header	**Directions: State to what degree you agree or disagree with the following statements.**					
		1	2	3	4	5
32	Smartphone use makes me feel more connected to other students.	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
33	Smartphone use makes me feel more connected with teachers.	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
34	Smartphone use makes me feel more connected with school activities.	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
35	Smartphone use makes me feel more connected with my family.	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
36	Smartphone use makes me feel more connected with my community.	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
37	Smartphone use makes me feel more connected with entertainment (i.e., games, movies, TV shows, music, etc.)	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
38	My teachers should plan more to use smartphone in their teaching.	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
39	Smartphone use connects me to society.	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
40	Smartphone use connects my cultural identity to society.	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
41	Smartphone use is a part of who I am.	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
42	Smartphone use connects me to community resources.	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
43	Smartphone use is essential to my life.	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Sub-Header	**Directions: State to what degree of usefulness of the following smartphone use.**					
		1	2	3	4	5
44	How useful do you think receiving notifications on your smartphone about class information (i.e., assignments, grades, tests dates, etc.)?	Not useful at all	A little Useful	Not Sure	Useful	Very Useful
45	How useful do you think receiving messages on your smartphone about discussion questions a day before class?	Not useful at all	A little Useful	Not Sure	Useful	Very Useful
46	How useful do you think using your smartphone to schedule meetings with your teachers?	Not useful at all	A little Useful	Not Sure	Useful	Very Useful

47	How useful do you think using your smartphone to meet with your teachers?	Not useful at all	A little Useful	Not Sure	Useful	Very Useful
48	How useful do you think receiving calendar reminders on your smartphone of school events?	Not useful at all	A little Useful	Not Sure	Useful	Very Useful
Sub-Header	**Directions: State to what degree you experience the following for smartphone use in school.**					
		1	2	3	4	5
49	How often do you use social media applications daily (i.e., Facebook, Instagram, SnapChat, Twitter, LinkedIn, etc.)?	Never	Rarely	Some of the time	Most of the time	All the time
50	How often do your teachers encourage smartphone use for learning in class?	Never	Rarely	Some of the time	Most of the time	All the time
51	How often do your teachers encourage smartphone use for learning outside of class?	Never	Rarely	Some of the time	Most of the time	All the time
52	If allowed by your teacher, how often would you use your smartphone to take notes in class?	Never	Rarely	Some of the time	Most of the time	All the time
53	If allowed by your teacher, how often would you use your smartphone to research subject topics on the Internet?	Never	Rarely	Some of the time	Most of the time	All the time
54	If allowed by your teacher, how often would you use your smartphone to access online audio/video recordings to learn more about your class content?	Never	Rarely	Some of the time	Most of the time	All the time
Sub-Header	**Directions: Provide your answers as indicated for each of the following:**					
55	Which social media platforms do you use? (Check all that apply.)	○ Facebook ○ Twitter ○ LinkedIn ○ Photo Sharing (i.e., SnapChat, Instagram, Flickr, etc.) ○ Video Sharing (i.e., TicTok, Instagram Reel, etc.) ○ Instant Messaging (Text, Messenger, WhatsApp, etc.)				
56	How would you prefer receiving information concerning school?	○ Email ○ Text ○ Pop-up Notifications ○ Phone Call/Voice Mail ○ Mobile App ○ Computer Web-based App ○ Website ○ Social Media				
57	How would you prefer receiving information concerning your classes?	○ Email ○ Text				

		○ Pop-up Notifications ○ Phone Call/Voice Mail ○ Mobile App ○ Computer Web-based App ○ Website ○ Social Media
58	State why you believe or do not believe that smartphone use in school is important.	(Open response)
59	What recommendation concerning smartphone use in school would you give your Principal/Head of School?	(Open response)
60	What recommendation would you give your teachers concerning smartphone use in class?	(Open response)

Header	**Section 4: Student Demographics**	
Sub-Header	**Directions: Please answer the following questions.**	
1a	Name of School	(Open response)
2a	Grade	○ 9th ○ 10th ○ 11th ○ 12th
3a	Age	12 thru 22
4a	Gender	○ Female ○ Male ○ Non-binary ○ Not listed ○ Prefer not to answer
5a	Race/Ethnicity	○ Asian/Pacific Islander ○ Black/African-American ○ Hispanic/LatinX ○ Native American/American Indian ○ Mixed ○ Not Listed ○ Prefer not to answer
6a	Do you have a physical or learning disability that requires accessible or adaptive technologies for your coursework?	○ No ○ Yes, I have one or more ***physical*** disabilities ○ Yes, I have one or more ***learning*** disabilities ○ Yes, I have ***both physical and learning*** disabilities ○ Prefer not to answer

7a	Do you (or your family) **own** any of these devices? (Check all that applies)	○ Chromebook ○ Desktop Computer ○ Laptop Computer ○ Smartphone ○ Tablet Device (e.g., iPad) ○ Do NOT own computing device
8a	Do you have access to any of these devices at your school? (Check all that applies)	○ Chromebook ○ Desktop Computer ○ Laptop Computer ○ Smartphone ○ Tablet Device (e.g., iPad) ○ Do NOT have access to any computing device
9a	Which device do you use most frequently to access the Internet?	○ Chromebook ○ Desktop Computer ○ Laptop Computer ○ Smartphone ○ Tablet Device (e.g., iPad) ○ Do NOT use any computing device
10a	On average, how much time do you spend on Internet-related activities (email, browsing, social media, etc.) **daily**?	○ Less than 1 hour ○ About 1 to 2 hours ○ About 3 to 5 hours ○ More than 5 hours ○ Do NOT spend any time
11a	Have you ever taken a course/class online?	○ Yes ○ No ○ Prefer not to answer

12a	What are your current grades in the core courses this school year?	○ ELA/ESL
		  ○ A, B, C, D, F, Not enrolled
		○ History
		  ○ A, B, C, D, F, Not enrolled
		○ Math
		  ○ A, B, C, D, F, Not enrolled
		○ Science
		  ○ A, B, C, D, F, Not enrolled

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