12-2021

Developing Digital Literacy in Digital Natives: A Quantitative Study of Digital Literacy and Niswonger Online Students

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Developing Digital Literacy in Digital Natives:

A Quantitative Study of Digital Literacy and Niswonger Online Students

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A dissertation

presented to

the faculty of the Department of Educational Leadership

East Tennessee State University

In partial fulfillment

of the requirements for the degree

Doctor of Education in Educational Leadership, Administrative Endorsement concentration

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by

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December 2021

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Keywords: online education, digital literacy, digital natives

ABSTRACT

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This non-experimental, quantitative study was completed to determine if Tennessee high school students who take an online, asynchronous course better their digital literacy through the environment of online learning. The study focused on the pretest and posttest scores of Niswonger Online students during the spring and summer semesters of 2021. It grouped the high school students by location, high school size, grade level, and courses taken to assess differences in digital literacy. Finally, it evaluated overall student growth in digital literacy scores after completion of an online high school course.

Data from a pretest and posttest of Niswonger Online students were used to assess growth in digital literacy scores after completing an online course. There were six Research Questions that guided this study with six significant findings: 1. Students who were excited about taking the online course had significantly higher levels of digital literacy on the pretest. 2. Students from small high schools (fewer than 1200) scored significantly lower on the pretest than students from larger high schools. 3. Students from rural high schools scored significantly lower on the pretest than students from urban or suburban high schools. 4. There was a significant difference in the means (lower) of Sophomore pretest scores in comparison to other grade levels. 5. There was a significant difference between the average growth scores of students in World Languages and Social Studies and World Languages and Career and Technical courses. 6. On average, students

who completed the Niswonger Online course scored significantly higher on the posttest than on the pretest.

DEDICATION

For Lucas, Sofia, and Nico. The why behind everything I do.

ACKNOWLEDGEMENTS

I would like to express the deepest appreciation to my committee chair and committee members for their leadership and guidance throughout this entire program. Dr. Virginia Foley has worked tirelessly to develop a program that has affected the lives of so many teachers, administrators, and, most importantly, students. Her mentorship, insight, and humor has been invaluable during this journey. Dr. John Boyd was an outstanding mentor and teacher whose smile always calmed me no matter what stress was rising on the horizon. Dr. Donald Good was the one who could explain anything, even Statistics and SPSS, in a way that even I could understand. To the final member of my committee, Dr. Jason Horne, it was such a pleasure to have an old friend along on this journey as a mentor, teacher, and committee member. Thank you for all you have done for me.

Also, a big thanks to my village that supported and encouraged me throughout this journey. My bosses, mentors, and dear friends, Dr. Nancy Dishner and Dr. Richard Kitzmiller have been such a blessing. When they believe in me, I feel can do anything. My girls- Miciah, Wendi, Dedra, Alex, and Emily. Thanks for being such wonderful friends and cheerleaders throughout this program. And finally, my husband Marcos, who never once questioned my ability to do this even when I did.

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Chapter 1. Introduction

Teenagers and young adults of the 21st century are called digital natives but many do not have the digital skills needed to succeed in the workforce (Ng, 2012a). This study reflected past research regarding digital natives and their digital literacy to better understand this disconnect between digital access and digital skills. Research was then conducted to expand knowledge in this area by giving Niswonger Online students in the spring and summer terms of 2021 a digital literacy pretest and posttest. These students were enrolled in at least one asynchronous online course with Niswonger Online. Some students were new to online, asynchronous learning; others had previously taken an online course via Niswonger Online or from their local school system.

Overwhelmingly, research has shown that the digital literacy skills needed to succeed in the early 21st century are not found in many young adults who themselves, and others, believe to be highly literate in technology (Calvani et al., 2011). A literature review was completed to understand the phenomena, and the digital literacy pretest and posttest were given to Niswonger Online students to ascertain their digital literacy before and after taking a fully online course. This study was conducted to better inform the actions of educators and policymakers who can work to diminish the divide between perceived and actual professional and educational technology skills.

History and Definition of Educational Technology

When researchers start the process to study the history of educational technology the first question that must be answered is what is considered technology (Saettler, 2005). The first insight into early educational technology can be found in cave drawings of bison dated to be 11,000 to 19,000 years old. These drawings show how man first started to share his survival knowledge with others past a fully oral tradition. The foundation of the term technology goes back to the early

Greeks (techne) and encompasses more than just the devices and programs that are thought of today. Changes in technology frequently create changes in teaching and learning, from the first writing utensils in each student's hand to the advanced use of smartphones, computers, and tablets used in classrooms.

Many definitions of educational and instructional technology have been proposed with some focusing on the devices or media used and others focused more on the theory of instruction rather than the hardware or software (Saettler, 2005). The first research-based definition was published by the Commission on Instructional Technology (1970), and without being too vague, attempted to define instructional technology as a mix of the technology resources used and the pedagogical theory behind it. The Commission concluded that instructional technology was a combination of technology resources and pedagogical theory to design, implement, and assess the processes of learning and teaching through human and nonhuman resources.

Teaching and Learning in an Online Environment

For any learning to take place, students must be engaged (Schlechty, 2011). This is true in the face-to-face environment and also in the online environment. Schlechty wrote about the importance of teachers being designers, not performers, and how this increases engagement and student outcomes in all classes. Teachers need to teach students to think and need to build trust with them to develop this critical relationship. Through group and individual activities connections must be made in the online environment to better the experience and outcome for all involved. The saying "Maslow before Bloom" is as paramount in the online environment as the classroom. Individual student needs must be met before educational objectives can be reasonably assessed. This was a significant focus for educators and administrators when school closures were imposed due to COVID-19 and online learning became vital (Pokhrel & Chhetri, 2021).

Li and Lalani (2020) estimated that 1.2 billion children have been disrupted by school closures during the pandemic. This sudden shift to online learning caused substantial growth in the adoption of educational technology and teacher and administrator training in the use of this new technology. The outcome of this is estimated to have an educational technology expenditure of over $20 billion dollars. Due to these expenditures and the first-hand accounts of success, many schools plan to make e-learning a part of the *new normal*. This rapid movement to online instruction, with little training and preparation for both students and teachers, has caused a negative experience for some. However, many educators are seeing the benefits of this new technology and how it will improve education both inside and outside the classroom.

In addition to teachers, many parents and students are enjoying the freedoms of online learning and are not willing to return to the past classroom schedules (Li & Lalani, 2020). This is a change that is being seen around the world. Schools and governments wonder how this will persist in the future and how this will continue to affect education in both pedagogy and expenditures. Even before COVID-19, there was high growth in the adoption of educational technology. It is now projected that investments in 2019 of $18 billion globally will rise to over $300 billion by 2025.

School advocates have always known the importance of being responsive to the needs of their students (Downes & Bishop, 2012). However, Downes and Bishop also noted that too many schools have fallen behind when it comes to meeting the needs of students and technology. To engage and guide students, educators must meet them at their level and combine both school life and home life. This can be done within an online environment as students already have an interest and, though not in an educational or professional setting, are already comfortable with

technology. Online learning can create “anytime, anywhere learning” that sets students up for success even without the walls of the classroom (Cope & Kalantzis, 2010).

Teaching and Learning in a Pandemic

Spring 2020 brought a disruption in education that no one could have predicted. It is estimated that more than a billion learners in over 200 countries were affected by school closures (Pokhrel & Chhetri, 2021). COVID-19 caused great change for all students from Pre-K to doctorate level through highly restrictive practices that moved students from a face-to-face learning environment in which they were very familiar to an online environment that was foreign and hard to navigate for both students and adults.

Online learning and distance education quickly became paramount, even with all the challenges that it posed to both teachers and students. Educators adopted emergency education plans and were compelled to move to the online environment, even though many agreed neither the teachers nor the students were prepared for it (Pokhrel & Chhetri, 2021). There is not a “one size fits all” solution to the issue schools were faced with but they found themselves having to find one product or program that they felt would help most, while knowing they were leaving some students behind. While some branches of government and our economy could shut down to try to slow or stop the spread of the virus it was always clear this was not an option for U.S. public education system.

The United Nations (2020) echoed closely the numbers found by Li and Lilani (2020) and Pokhrel and Chhetri (2021) and stated that in July of 2020 it was estimated that 98.6% (1.6 billion) of learners in the world were affected by COVID-19. Challenges that administrators, teachers, and students were faced with will be discussed, and studied, for years to come. However, the knowledge and opportunities that arose from this pandemic can be something that

benefits education well into the future (Pokhrel & Chhetri, 2021). Teachers who taught the same class for 20 years were suddenly having to make changes, explore, and be more creative. The collaboration between schools and parents grew exponentially and overall, online learning provided teachers the opportunity to teach in a more innovative way. In addition, the collaboration among teachers got stronger as they worked together to meet the needs of their students (Doucet et al., 2020). As posited by Pokhrel and Chhetri (2020), this evolution of teaching, communication, and digital skills will not be lost and will benefit education long after COVID-19 has passed.

For students to stay on track, and be ready for the future, there is a need for digital literacy skills (Bergson-Shilcock, 2020; Cummins et al., 2019; Henrichson & Coombs, 2014; Ng 2012a). This was highlighted around the world due to COVID-19 and school closures (Pokhrel & Chhetri, 2021). A better understanding of students' digital literacies and technology use can enhance pedagogy in all subject areas. Wilson et al. (2015) hypothesized the biggest reason for this gap in research is that most people assume students are highly literate in technology by the time they reach high school. This assumption is made because most students have had ample access to technology most of their lives. As revealed in the literature review to follow, this is an unfounded assumption that is holding students back from getting the digital literacy background needed to succeed in today's world (Calvani et al., 2012; Digby & Bey, 2014; Ng, 2012a, 2012b; Scolari, 2019; van Duerson & van Dijk 2012).

Statement of the Problem

Many students and young adults today, who have grown up immersed in the world of technology, are not digitally literate (Ng, 2012a). This issue has been studied throughout the past two decades (e.g., Calvani et al., 2012; Gross & Latham, 2012; Kaminiski et al., 2003; Ng,

2012a), yet its importance has been amplified due to the COVID-19 pandemic and the move of students in all grade levels to online, hybrid, or blended learning. Ultimately, this sudden move to online learning may strengthen digital skills of students (Buchholz et al., 2020). However, in the spring and fall of 2020, teachers and administrators quickly realized that even their top students struggled with skills that professionals would consider basic. Tasks such as emailing, sharing documents, and uploading or downloading work were all new undertakings to many high school students. It then became the job of classroom teachers, who themselves sometimes struggled to move their course online, to teach not only their core subject, but also various technology skills that they assumed their students knew.

Significance of the Study

The same way Kindergarten teachers spend purposeful time showing students how to hold and use a pencil, teachers of all grade levels must now teach students how to use the technological devices that are being placed in front of them. The results of this study may help develop policy and professional development in regards to teaching and learning digital literacy in the online environment. Teachers modeling and encouraging students to learn and create in digital environments will not only make the students more successful now but also in the future (Wilson et al., 2015).

Purpose of the Study

The purpose of this non-experimental quantitative study was to further the understanding of how to develop digitally literate students to better prepare them for postsecondary education and career. Pretest and posttest data were used to evaluate the role that fully online courses can play to better secondary students' technology skills while learning needed subjects in the online environment.

Research Questions

This research tested the hypothesis: There is a positive relationship between students who take Niswonger Online courses and growth in their digital literacy scores. A digital literacy pretest and posttest was used to evaluate students' digital skills and addressed the following research questions:

RQ_1: Is there a significant relationship between students' attitudes towards online learning and digital literacy pretest scores when starting an online course?

RQ_2: Is there a significant difference in digital literacy pretest scores between students who attend small high schools (population less than 1200) and students who attend larger high schools (population greater than 1200)?

RQ_3: Is there a significant difference in digital literacy pretest scores between students who attend rural high schools and students who attend urban or suburban high schools?

RQ_4: Are there any significant differences in the digital literacy pretest scores among grade levels (Freshman, Sophomore, Junior, Senior)?

RQ_5: Are there any significant differences in the growth of digital literacy among courses taken? (Career and Technical, English Language Arts, Math, Social Studies, Science, World Languages, Fine Arts)?

RQ_6: Is there a significant difference between students' digital literacy before and after taking a Niswonger online asynchronous course?

Theoretical Framework

This correlational study measured changes in digital literacy among digital natives who have taken an online asynchronous high school course with Niswonger Online.

Two theories have been extensively studied in regards to digital natives and levels of digital literacy and are the foundation of this research:

1. Digital natives are not inherently digitally literate (Calvani et al., 2012; Digby & Bey, 2014; Ng, 2012a, 2012b; Scolari, 2019; van Duerson & van Dijk 2012).

2. Digital natives can quickly become digitally literate when exposed to educational and professional digital resources (Bergson-Shilcock, 2020; Calvani et al., 2012; Ng, 2012b).

Definitions of Terms

The following terms are defined to better understand this study:

Asynchronous Online Learning- self-study and online interactions with peers and teachers in which remote learning resources are used without the requirement of meeting face-to-face or online at any certain time (Hiltz & Goldman, 2005)

Blended/Hybrid Learning- a combination of both formal and informal teaching and learning set in both classroom and online environments (Abdelrahman & Irby, 2017)

COVID-19- Coronavirus Disease 2019- a highly contagious virus first documented in December of 2019 (CDC, 2020)

Digital Creator- digital users who, in addition to consuming, socializing, and playing in the digital environment also create and share their own content (Ballano et al., 2014).

Digital Competence- skills and attitudes towards technology that develop as a user creates, solves problems, communicates, and manages information online (Skov, 2016)

Digital Consumer- passive users of technology who consume information without actively participating or creating in the digital environment (Ballano et al., 2014)

Digital Divide/Digital Exclusion- differences in device access, skills access, and usage access among digital tools (Brake, 2013).

Digital Immigrant- a person born before 1990 who has had to adapt to technology (Prensky, 2001)

Digital Literacy- the ability to create, communicate, and collaborate effectively in the digital environment (Hague & Paton, 2010).

Digital Native- a person who has grown up in a digital environment where digitally related activities have always been part of their daily lives (Ng, 2012a).

Educational/Instructional Technology- a combination of technology resources and pedagogical theory to design, implement, and assess the processes of learning and teaching through human and nonhuman resources (Commission on Instructional Technology, 1970)

Information and Communication Technology- the use of digital technology to create, communicate, access, manage, integrate, and evaluate information (ETS, 2002)

Large School- school with 1,200 students or more

Netiquette- social and moral code of online effective communication (Chiles, 2013)

Niswonger Online- Niswonger Foundation's online learning program that offers online secondary courses to students throughout Tennessee

Rural Area- all areas outside of the Census Bureau defined Urban Area (Cromartie, 2012)

Small School- school with fewer than 1,200 students

Urban Area- densely populated area with 50,000 people or more (Cromartie, 2012)

Limitations and Delimitations

This study population was comprised of students enrolled in at least one Niswonger Online course during the spring and summer 2021 semesters. This study exclusively involved secondary students (grades 9-12) within the state of Tennessee. Personal factors that could impact a student's performance were not taken into consideration. Limitations also exist in

regards to the pretest and posttest instrument used. This study does not involve data from terms before spring 2021 or after summer 2021. This study was also delimited to students who completed both the pretest and posttest. Data from students who did not finish the course or did not complete the final posttest survey were not part of the calculations. Results of the study are not necessarily generalizable to other populations or in other settings.

Chapter Summary

Chapter 1 of this study contains an introduction to the topic, history, terms, framework, and significance of the study. Chapter 2 contains a review of literature focusing on the problem and past research on digital literacy. Chapter 3 covers the quantitative method used in this research including population, instrumentation, data collection methods, and data analysis. Chapter 4 includes a deeper analysis of the data in regards to the research questions and hypothesis. Chapter 4 also includes charts and tables to better understand the data collected. Chapter 5 concludes the study with a narrative of the findings, implications for future practice within education, and proposals for additional studies to broaden the understanding of this phenomena.

Chapter 2. Review of Literature

As technology use increases in our society, educators and policymakers must understand that not all students and young adults are digitally literate. Digitally literate adults are needed not only in specialized professions but are in demand throughout the workforce and economy (Bergson-Shilcock, 2020; ETS, 2002; OECD, 2015). Current technology advancements are increasing automation, therefore decreasing the number of jobs, especially low-skilled positions (Arnitz et al., 2016). This change in workforce demand makes it imperative that those involved with the development of students today for tomorrow's jobs understand that not all students have the skills needed to succeed in a digital world (Cummins et al., 2019).

In addition to the workforce, young adults have also been living through significant changes in education that involve digital tools and online learning. Studies overwhelmingly cite poor performance in online courses at the college level (Bawa, 2016; Bettinger et al., 2017; Xu & Jaggers, 2011). Since postsecondary schools cannot go back to fully face-to-face teaching, some states have mandated high school students take an online high school course before graduating (Hart et al., 2019). This focus on online learning in both secondary and postsecondary environments further stresses the importance of digital literacy. Both online advocates and critics understand that skills learned in digital learning environments are advantageous to students in a world that rewards digital competencies (Sheehy, 2012).

Digital Natives

In a world where even the youngest of children are seen with devices in their hands, a term such as digital native seems to make sense. Assumptions about these children, students, and young adults are easily made and are overwhelmingly positive regarding their digital abilities (Gross & Latham, 2012; Ng, 2012a). Prensky (2001) first termed digital natives as a generational

group born after 1980. He described this group as people who grew up immersed in technology and therefore thrive in the online world, both creating and sharing. These people have e-lives that revolve around gaming, social media, online music, and quick access to information.

Defining Digital Native

There has been ample debate around digital natives and perceived versus actual digital literacy. Ng (2012a) argued that generalizing digital natives to just a generation is like generalizing all baby boomers as having the same attributes because they were born between 1946 and 1964. The term native can relate to how often someone uses technology within their lives, yet, it cannot also be assumed that everyone born after 1980 has comfort with using technology in educational or professional environments.

Digital natives typically refer to those who have grown up in a digital environment where digitally related activities are part of their everyday lives. However, even with this immersion, there should be no positive assumption of technology skills (Ng, 2012a). Digital natives tend to happily learn social networking applications or entertainment tools but are not likely to learn the more professional aspects of technology unless exposed to it in education (Ito et al., 2008). Peer use will often lead students to new technology, yet educational technologies are not something that digital natives seek out. For students to learn the professional side of technology they must be given that opportunity in a professional learning environment.

One issue facing digital natives and their digital literacy is that most students and young adults believe they are digitally literate (Ng, 2012b; Scolari, 2019). This is again due to the lack of exposure to digital learning tools or programs. For example, a student will not automatically know about online resources to help them study for an Algebra test unless an educator or adult shares these resources with them. This further divides the digital educational landscape for

students and highlights the varying use of technology by digital natives. This uneven exposure to digital tools and how to use them for learning makes it imperative that the term digital native not imply any certain skill level within technology.

Multiple studies (e.g., Ng, 2012b; Scolari, 2019) turn these positive assumptions of digital literacy among the young upside down. Young adults thrive within online social media and gaming environments yet, often struggle in the educational and professional digital domains (Calvani et al., 2012; Ng, 2012a). This lack of connection between a student's self-view of skills and their actual skills has been equated to the Dunning-Kruger Effect. Dunning (2011) referred to this as a person's ignorance of their own ignorance. This arises as a lack of knowledge in an area and often leads a person to believe erroneous information solely because it appears to be correct. This is a problem among digital natives because people will not seek out help for a skill they believe they have (Gross & Latham, 2012).

Digital natives' confidence in their digital ability hinders them from wanting to better themselves. This ignorance compiled by others' high assumptions of abilities only causes confusion when educators are trying to pinpoint discrepancies in teaching and learning. Gross and Latham (2007) established the Dunning-Kruger Effect among students and digital literacy skills by studying first year college students. The students were asked to estimate their performance before and after a pretest and posttest. Students who scored below average believed they would score above average both before and after taking the test. This misalignment of confidence and skills was directly in-line with previous Dunning-Kruger experiments.

Various studies, both nationally and internationally, have been conducted over the past decade that show while digital natives have always lived in a world with technology and Internet access, their digital literacy skills vary widely (Calvani et al., 2012; Digby & Bey, 2014; Gross &

Latham, 2012; Ng, 2012a, 2012b; Scolari, 2019; van Duerson & van Dijk 2012). Li and Ranieri (2010) conducted a study with Chinese teenagers that further aligned with these findings showing that even when 87% of the participants had a computer at home and 78% had broadband Internet access, their highest performance level on the Instant Digital Competence Assessment was at the "pass level". While this is passing, it is well below the assumed "good" or "excellent" levels that were expected.

Through educator interviews, Digby and Bey (2014) concluded that adults and children who frequently use digital skills for entertainment cannot be assumed to have digital literacy skills needed for work and education. Li and Ranieri (2010) also posited that the frequency of use alone was not enough to predict performing well on any digital literacy assessments. Consequently, this discrepancy between digital natives and their digital literacies causes young adults to struggle with the everyday technology found in postsecondary education and careers (Bergson-Shilcock, 2020).

An understanding of digital natives and their actual digital literacy skills is imperative as we move forward in teaching and learning (Wilson et al., 2015). This information will better the understanding of the use of technology among digital natives and how to encourage that use for learning. It is also vital in a world where digital immigrants are mostly the ones teaching the digital natives (Bennett & Maton, 2010). A digital immigrant is someone who was born before 1990 and had to adapt to technology instead of being born into a digital society (Prensky, 2001). Motivating students in a world of technology is difficult. By understanding the digital literacy of both the digital natives and digital immigrants, research and policymakers can posit how to help both as education moves deeper into the 21st century.

Access and Use

Globally, people should have equal access to all opportunities (United Nations, n.d.). This holds true for technology and holds true with digital natives. Some born during the digital age have access to technology daily, both at home and school. On the other end of the spectrum, others have little to no access, especially in professional school settings that teach digital literacy skills. This lack of access to technology resources is called digital exclusion.

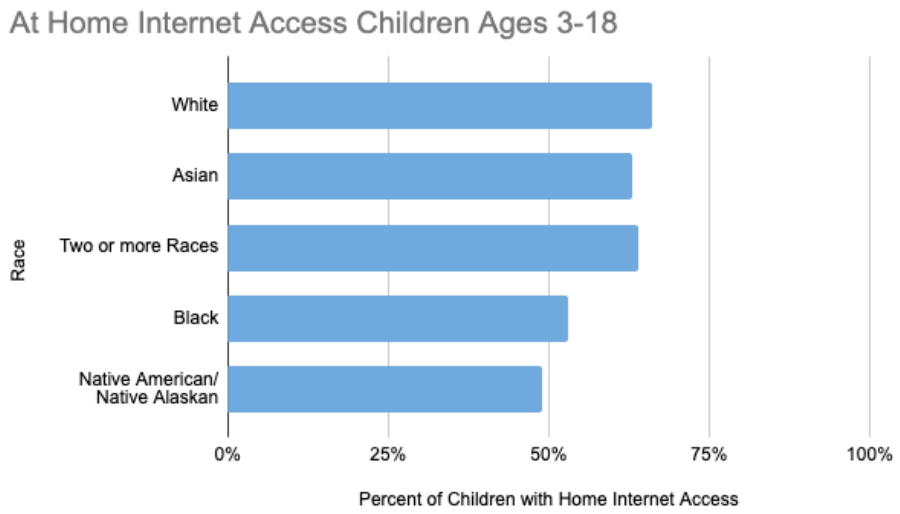
The Organization for Economic and Cooperation Development (OECD) (2013) studied the Program for the International Assessment of Adult Competencies (PIAAC) results and highlighted that the only developed country tested with a substantial difference between digital literacy among minorities, genders, and income levels was the United States. Across the OECD countries there was a weak relationship between gender and immigration in regards to digital literacy skills. However, in the U.S., even after controlling for age, education, and employment status, white, U.S. born, males scored significantly higher on digital problem solving skills. Hence, though the U.S. is the leader in technological advances, the benefits of this technology do not reach all Americans.

Digby and Bey (2014) defined digital divide as referring to a person's ability to access and use technology. Though infrastructure improvements and technology grants have made it easier for most students to access a device and the Internet, there is still opportunity to shrink this divide. Many studies reported schools are the ideal place to bridge this gap by being able to allow everyone access to technology and model its proper use (Calvani et al., 2012; Ng 2012a). Bennett and Maton (2010) further echoed this by stating that though young people grow up with technology, they have very different versions regarding its use. Home access to technology does not guarantee proper use and is not guaranteed to break down this digital divide.

Policy should be implemented to reduce digital exclusion as it affects the poor and marginalized more than others and reinforces the stigma of exclusion from society and the workforce (Bejakovic & Mrnjavac, 2020). Data regarding home computer and Internet access from the National Center for Education Statistics *(NCES, 2017)* are summarized in Figures 1-3.

Figure 1

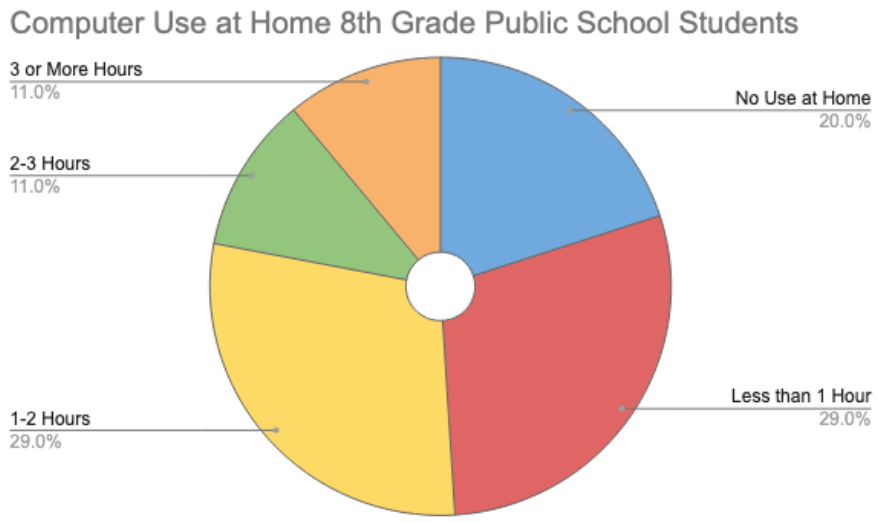
At Home Internet Access Children Ages 3-18



Created using data from *Student Access to Digital Learning Resources Outside of the Classroom* (NCES, 2017).

Figure 2

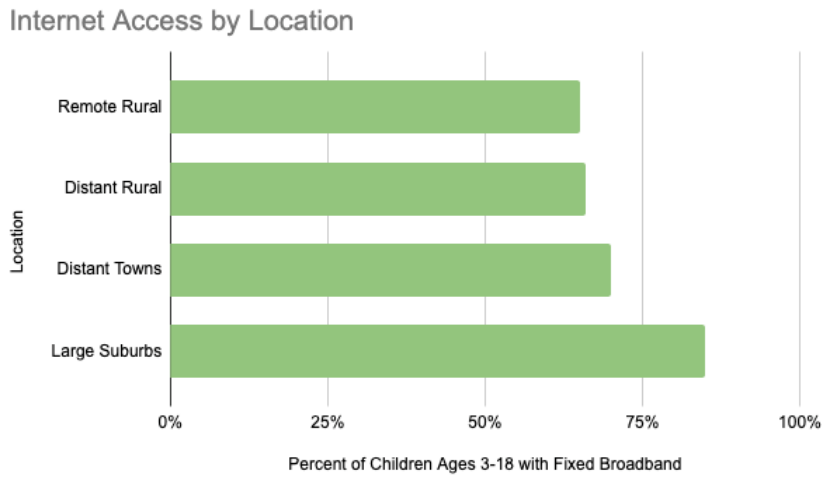
Computer Use at Home- 8th Grade Public School Students



Created using data from *Student Access to Digital Learning Resources Outside of the Classroom* (NCES, 2017).

Figure 3

Internet Access by Location



Created using data from *Student Access to Digital Learning Resources Outside of the Classroom* (NCES, 2017).

As shown in Figures 2-4, Internet and home computer access vary greatly, and the key factors to these barriers are location and income (NCES, 2017). There remains a digital divide of the less educated, rural populations in relation to the more educated, urban and suburban populations. The lack of digital skills creates an environment in which adults who are not digitally literate have a lower rate of employment, and those who are employed, work in lower-skilled, lower paying jobs (Bergson-Shilcock, 2020).

In addition to basic access, it is essential to note that exposure to the digital world in more professional and educational contexts varies greatly among digital natives. This variance of exposure to professional programs, apps, or devices also creates a divide among young adults and their digital abilities. Bergson-Shilcock (2020) stated that almost one-quarter of all U.S. workers between the ages of 16-34 have no digital skills; therefore, "a young person might be

confident in making a quick TikTok video but stymied when it comes to using a spreadsheet" (p. 15).

Green and Hannon (2007) categorized these different digital users based on their skills and daily use; creative producers, digital pioneers, information gatherers, and everyday communicators. Creative producers are producing; they are making new websites, YouTube videos, and blogs that can be shared with everyone. Digital pioneers were learning to code and share within the digital world before it was cool through media such as blogs or vlogs. Information gatherers are those who live in Google and Wikipedia, not digital creators but digital consumers of information. Everyday communicators have all the online applications, excel in texting and messaging in social media but, as with the information gatherers, are mostly consumers in the digital world.

Creative producers, digital pioneers, information gatherers, and everyday communicators are found in all age levels. It is also common to find the same people moving throughout those groups daily (Green & Hannon, 2007). However, it must be understood that the ability to move throughout these categories and operate in some capacity within them does not make a person digitally literate. Not all are using technology in the same way and those differences in how it is used and what it is used for cause stark differences in their levels of digital literacy (Bennett & Maton, 2010; Scolari, 2019).

Technology Consumption versus Creation

Emphasizing the difference between creating with technology and consuming technology is also an important factor of digital literacy (Wilson et al., 2015). Consumers merely find and use online content where creators develop and share. Both are ways of learning in the digital world, however, creating through technology is a richer experience that allows for students to

dive deeper into the technical and soft skills needed for the online environment. As stated by Bennett and Maton (2010), just seeking out information, known as consumption, limits a person who might be needing to acquire other skills only developed by those who synthesize and create digitally.

Students and adults must have the ability to make meaning out of resources found and the resources they create. A wide range of skills is needed when producing and disseminating digitally (Henrichson & Coombs, 2014). When a learner is constructing the text, choosing programs, fonts, and ways to share, digital literacy skills move to a greater level of understanding.

Scolari (2019) concluded that digital natives do not come with a "built-in chip" that allows them to move seamlessly through all technology. Digital literacy skills are unbalanced among teens and young adults and studies overwhelmingly conclude that an optimistic assumption of digital natives' technology abilities is baseless (Calvani et al., 2011; Digby & Bey, 2014; Li & Ranieri, 2010; Ng, 2012a). Furthermore, this imbalance of digital literacy is not going to correct itself (Hinrichsen & Coombs, 2013). The disproportion of such important skills creates an arena in which educators must step in to fill these deficits to prepare students for postsecondary education and career (Bulfin & McGraw, 2015).

Digital Literacy

The ability to understand and excel in the world today, both in print and digital environments, requires more than the literacies of the early 2000s (Bulfin & McGraw, 2015). Students and young adults need training in what Osterman (2012) called New Literacies, which includes, but is not limited to, information literacy, visual literacy, media literacy, and the broader term that encompasses cognitive thinking and strategies, digital literacy. Digital literacy

is needed by all to navigate both professionally and socially in today's economy (Cummins et al., 2019).

Gilster (1997) first coined the term digital literacy. Instead of focusing on merely technology skills, Gilster took it a step further to describe it as a mindset; "digital literacy is about mastering ideas, not keystrokes" (p. 15). This new focus on digital literacy created a growth mindset around technology that expanded the foundation from how to consume technology to how to create, self-direct, and synthesize information with it (Bawden, 2008). This broad concept did not restrict the term digital literacy to just specific technical skills or programs learned. It expanded it to personal attributes that allow the ideals to stay strong even as technology changes.

Defining Digital Literacy

Over time there have been varying definitions of digital literacy (Bawden, 2001; ETS, 2002; Gilster, 1997; Hague & Payton 2010; Ng, 2012). While they often differ on the specificity of the procedural, social, or cognitive skills required, all agree it is a necessary life skill in the 21st century. Indicating that it is important to note that a holistic view of digital literacy is vital, Gilster (1997) stated it is more than just knowing the technical how-to.

The original definition of digital literacy concluded it as a mix of both concrete skills, the ability to develop and collaborate in the digital world, and soft skills, the ability to communicate and understand cultural etiquette. Throughout life, a person's digital literacy skills will evolve as the person changes (Bawden, 2008). The capacity to update one's abilities as technology and jobs change makes the skills associated with digital literacy in high demand. Digital literacy encourages lifelong learning. The growth mindset associated with this skill set is needed by all, no matter their profession or goals.

Hague and Payton (2010) define digital literacy as

> To be digitally literate is to have access to a broad range of practices and cultural resources you are able to apply to digital tools. It is the ability to make and share meaning in different modes and formats; to create, collaborate, and communicate effectively, and to understand how and when digital technologies can best be used to support these processes (p. 2). The eight components include creativity, critical thinking and evaluation, cultural and social understanding, collaboration, find and select information, effective communication, e-safety, and functional skills. (p. 19)

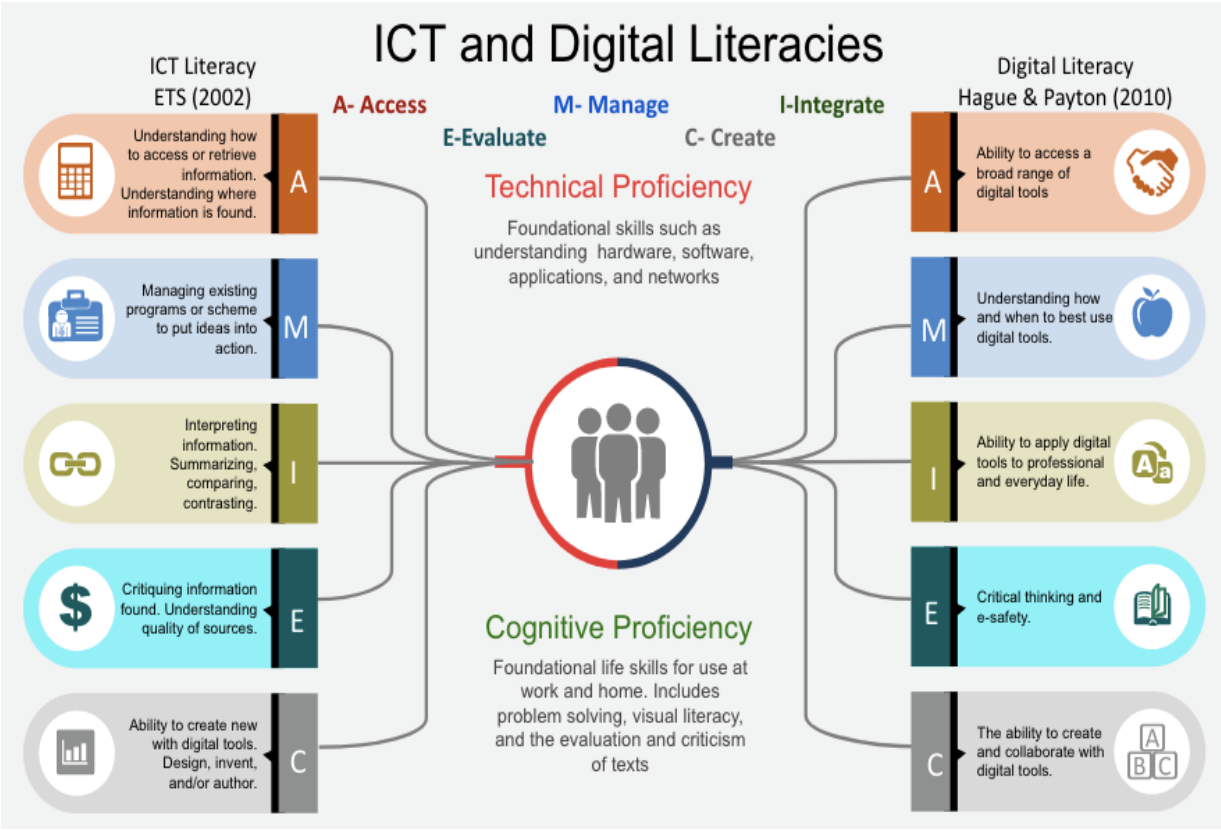
It is also important to note that there are many terms used synonymously with digital literacy among varying studies. Terms such as Information and Communication Technology (ICT) literacy, computer literacy, digital competence, media literacy, information literacy, and 21st century skills are all found in the literature. Though there are overlapping definitions among these terms true digital literacy is a combination of technical, social-emotional, and cognitive skills that include evaluating digital resources with a mindset of lifelong learning (Gilster, 1997; Mamedova & Pawlowski, 2018; Ng, 2012a).

To terms are considered synonymous with digital literacy, Information and Communication Technology (ICT) Literacy (ETS, 2002) and Digital Competence (Skov, 2016). ICT Literacy is based on digital technology use to create and communicate, to access, manage, integrate, and evaluate digital information. Digital Competence combines not only skills but also attitudes towards technology to support a user as they create, solve problems, communicate, and manage information. It also focuses on the understanding of online safety, critical thinking, and ethics.

As technology impacts most people of the world, digital literacy must be a universal term covering the technical, cognitive, and social aspects of technology in our lives. Digital literacy helps citizens keep up with the ever-changing world (Ferrari et al., 2012). It is a constant development of skills plus a growth mindset that allows a person to learn and adapt (Ng, 2012b). Figure 4 represents the characteristics of digital literacy and illustrates the commonalities of ICT literacy and digital literacy.

Figure 4

The Intersection of ICT Literacy and Digital Literacy



Adapted from digital literacy definitions of ETS, (2002); Hague & Payton (2010).

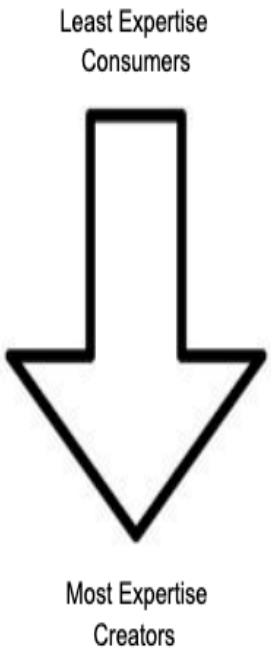
In January 2001, Educational Testing Services (ETS) brought together a group of international experts from education, government, and non-governmental agencies to form a committee to define and build a framework to assess Information and Communication

Technology (ICT) literacy. The committee's goal was to understand ICT literacy and its effect on global workforces and the economy (ETS, 2002). The ICT team developed a foundational set of skills that must be present for a person to be digitally literate. They range in complexity and are directly related to how much knowledge and expertise the user has in the digital realm.

Figure 5 represents the growth of digital literacy based on skillsets that all digitally literate must acquire. These skills are fluid as digitally literate people move throughout them daily. Yet, all five must be present to guarantee that a digitally literate person is not just consuming technology but also creating with it. The ICT Literacy Framework is a foundational study (ETS, 2002) that has been examined and cited throughout the past two decades, including framework studies cited within this research from Hague and Patton (2010) and Ng (2012).

Figure 5

Skillsets of the Digitally Literate



Access- knowing about and knowing how to collect and /or retrieve information.

Manage- applying an existing organizational or classification scheme.

Integrate- interpreting and representing information. It involves summarizing, comparing, contrasting.

Evaluate- making judgments about the quality, relevance, usefulness, or efficiency of information.

Create- generating information by adapting, applying, designing, inventing, or authoring information.

Adapted from ETS, 2002, p.17

Characteristics of Digitally Literate Americans

Understanding those in the United States who are digitally literate and those who are not is important when hypothesizing how to bridge the gap. The Organization for Economic Cooperation and Development (OECD) created the Program for the International Assessment of Adult Competencies (PIAAC). The OECD is well known for developing data assessments that are taken internationally. Educators may be most familiar with the Program for International Student Assessment (PISA). The PIAAC measures competencies in adults ranging from numeracy to reading literacy. In 2012, for the first time in an international study, the PIAAC assessed an adult's ability to "problem solve using computer technologies" (Mamedova &

Pawlowski, 2018, p. 1). The PIAAC assessment also evaluated familiarity with electronic images, texts, graphics, and the ability to locate and critique the accuracy of digital information. These skills were evaluated by simulating tasks that are often performed in the work environment such as using spreadsheets, solving low-level technical problems, and managing personal information.

The decision of PIAAC to add digital problem-solving skills to the assessment is premised on knowing that to operate in today's digital world effectively, adults need to master certain foundational technology skills (Mamedova & Pawlowski, 2018). Adults who displayed at least some level of fluency in a long list of skills that ranged from technical to cognitive were then termed as digitally literate. Those who did not have the basic skills or could not participate in the assessment's digital portion were labeled as digitally illiterate (OECD, 2013). OECD findings from the 2012 PIAAC showed that 16% of Americans, ages 16-65, were not digitally literate. That is approximately 31.8 million people in the U.S. workforce who do not have necessary computer skills.

As our economy continues to move toward a digital age, it is important to know who these people are as a lack of digital problem-solving skills is a barrier to labor force entry and promotion (Mamedova & Pawlowski, 2018). The biggest factor affecting digital literacy within the OECD report was educational attainment. Roughly 41% of U.S. adults without a high school diploma are digitally illiterate, compared to only 5% of adults who have a college degree. Overall, adults who are not digitally literate tend to be older and less educated. They also have lower employment rates and work in low skilled jobs (OECD, 2013).

Bergson-Shilcock (2020) took the data from the 2012 PIAAC assessment a step further and looked at workers considered to be digital natives among the U.S. population. They found

that “younger workers are not immune to digital skills gaps” (p. 15). Specifically, 24% of U.S. workers between the ages of 16-34 had no digital skills. They also compared these digital literacy skills to those of their international peers and found that those aged 16-34 scored lower than 17 out of the 18 countries that participated in the study. These numbers show a grim reality for the future of our workforce. Further emphasizing the importance of digital literacy in our country.

Importance of Digital Literacy

Digital literacy is no longer an option but a must for adults in today’s world. It is an employment requirement for most fields and especially important for the advancement within a field (Bejakovic & Mrnjavac, 2020). A person must be digitally literate to educate themselves and further their career trajectory. It is also a necessity to participate in the digital economy which was already a world that was growing exponentially before the COVID-19 pandemic of 2020.

The importance of digital literacy is also revealed as educators move forward to discuss what is called multiliteracies. Cope and Kalantzis (2000) acknowledged this in a study of how the global economy is engaging through various technologies and increasingly becoming more connected. This research focused not only on the cognitive aspect but also on the social-constructive nature of students’ reading literacy. The study concluded that meaning is developed through a range of multimodal texts and stresses the importance of learning the cultural and technical facets of this new literacy. This past decade has seen tremendous change in communication and again has brought about important changes to what once was considered literate (Wilson et al., 2015).

To keep pace in the world today, and develop adults who are ready for the world of tomorrow, students must be prepared to learn in a flexible environment (Wilson et al., 2015). Reading and writing skills are important but they also must learn how to manage the technology they use to communicate (Glaus, 2014). Digital literacy skills of both secondary and postsecondary students continue to concern educators and administrators (Gross & Latham, 2012). These concerns are not new and not only based in the learning of core subjects, such as reading and math, but also subjects such as cybersecurity and digital citizenship.

Access to Education

Digital literacy is becoming fundamental to our education system, especially among postsecondary institutions. Research completed almost 20 years ago still holds true today; understanding technology is fundamental to people in our society, as essential as reading, writing, and math (Kaminiski, 2003). Hart et al. (2019) echoed this sentiment, stating that learning in the online environment will always be advantageous to students who live in a world that rewards digital literacy.

A lack of digital literacy also creates a cycle in which one cannot become digitally literate without going back to school, however, to succeed at school they must be digitally literate. This cycle of not being able to advance or become part of the workforce without being digitally literate, yet not being able to become digitally literate because of a lack of digital skills is a reality for many in the United States (Bergson-Shilcock, 2020; Cummins et al., 2019). In the fall of 2018, 5.7 million, or 34% of all undergraduate students learned using distance education (NCES, 2018). Of that 5.7 million, 2.3 million took distance learning courses exclusively. These numbers include both 2-year colleges and 4-year universities.

Online learning's allure and flexibility are spread throughout the postsecondary environment and found as options within most majors. Even technical certificate programs and majors seen as very hands-on, such as Machine Tool Operations or Automotive Service, have fully online offerings of math and safety courses needed for graduation (e.g., Northeast State, n.d.). This further shows that in the world today, even those who have no intention of working with computers will at some point be taught through one. This change in education is also a mirror to society. Needed digital skills obtained, for example in an online Automotive Engine Analysis course, can be extended to job skills when a mechanic is introduced to the company's hardware and software system for customer management, engine diagnosis, and repairs (Cummins et al., 2019).

Digital literacy is also key for adults who did not finish high school but hope to attain their Graduate Equivalency Degree (GED). Digby and Bey (2014) reported that most adults were studying for the GED independently through online resources. In most states and regions, the GED is an online-only format only allowing paper tests for those who need an accommodation due to a disability (*Taking the GED Test on a Computer*, n.d.). This shift from paper to online causes challenges and anxiety to those who want to better themselves, however, lack the skills necessary to work or navigate through a computer.

Within Tennessee, GED tests have been replaced with the High School Equivalency Test (HiSET) (Adult Education, n.d.). The HiSET, delivered by Educational Testing Services (ETS), can be taken by any adult who left high school before graduation and allows them to earn a high school equivalent (HSE) diploma to then move on to postsecondary work or to better their career (*What is High School Equivalency*?, 2021). HiSET courses and tests are given in a fully online format to prepare adults for the exam. Residents of Tennessee have the option of doing this fully

online program and can request a waiver for the testing fee if they can pass a practice test after the courses are completed. This opportunity allows adults to gain their HSE diploma and the state promotes the program as being one that is easily accessible to all due to the online format.

Specific data regarding Tennessee and success rates with the HiSET program could not be found. However, another study, based out of Knoxville, TN, echoed what has been mentioned above when understanding how the lack of digital literacy can hinder those trying to better their education. Brinkley-Etzkorn (2016) found through teacher interviews that many adult basic education (ABE) students require assistance, even before the addition of technology. They worried greatly about the barriers that the online format would cause for many students. One teacher elaborated by saying she worries some of her ABE students will have to learn how to type before they can learn what is needed for the test or how to take the test.

Data overwhelmingly show that online courses are expanding rapidly within education (Hart et al., 2019) and a lack of digital literacy among students and adults can cause barriers to furthering education and career. "A single period of formal schooling is no longer adequate to keep up with changes in skills demanded by employers in the technology-rich societies" (Cummins et al., 2019, p. 188). Educators, researchers, and policymakers must understand that the foundation to this issue is not always a rejection of schooling but sometimes the lack of ability to succeed in the online educational environment (Bergson-Shilcock, 2020).

Access to the Workforce

Digital literacy is an essential skill in today's workforce (Jose, 2016). The ability of workers to transition from one technology to another, or the open mindset to keep updating skills and learning, has already become commonplace among 21st century employers (Ng, 2012b). The importance of digital literacy in relation to economic wellbeing is not new and was stressed by

Wynne and Cooper (2007) in older research. They predicted that the lack of digital literacy among Americans would have a negative impact on economic growth and competitiveness.

Today, most workers need digital skills just to apply for a low wage, entry-level job (Bergson-Shilcock, 2020). Young adults no longer go to the brick and mortar location asking for an application and use pencil and paper to complete. They are now sent to websites where they must understand how to upload a resume, complete and submit necessary documents, and frequently must take entry-level online exams. As an example, to apply to work at McDonald's, potential employees must complete an online application and take an online personality test that can take up to an hour to complete (McDonald's Careers, n.d.).

Digital skills are also requirements for most careers and are in high demand across the job market of the United States. Bradley et al. 2017, concluded that "more than 8 in 10 middle-skill jobs (82%) require digital skills, a 4% increase since 2015" (p. 3). This report focused on middle-skilled American workers and how increased technology skills can lead to better pay and job advancement. As shown in the research below, it is needed for most middle and high skill jobs and can be used to enter the workforce and advancement within a career even without a postsecondary degree. By mining a data set consisting of almost 27 million U.S. job postings, Bradley et al. reported the following:

- Digital middle-skill jobs pay 17% more than non-digital middle-skill jobs
- Digital skills provide a path to middle-skill and high-skill jobs
- The average pay for digital middle-skill jobs was $20/hour
- 78% of the digital middle-skill job postings required baseline digital skills that included spreadsheets and word processing

- Within this data set, there were only three career clusters of non-digital middle-skill jobs; transportation, construction, and repair. This shows the importance of digital skills as it was a requirement for the other middle-skill clusters.

The importance of digital skills to enter and advance in the workforce is further noted when looking at changes in jobs since the 19080s. Since 1980, the number of U.S. jobs now requiring advanced digital skills has grown from roughly 5% to 23%. The number of jobs not requiring any digital skills has dropped from 56% to less than 30% (Muro et al., 2017). Digital literacy is also of high importance as jobs across the country change and new jobs are created. Since 2010, of the 13 million new jobs created, almost two-thirds of those postings required medium to advanced levels of digital skills (Alden & Taylor-Kale, 2018).

When looking to the future of workforce development it is important to note that many students will be working in jobs that are yet to be known. For example, Web developers did not exist in the early 1990s, yet in 2019 over 174,000 were employed with a median salary of $73,760 (Bureau of Labor Statistics, 2020). Preparing students for jobs that do not exist means showing them how to learn both inside and outside the classroom to keep their skills high as demands change.

Life Skills

Instilling an awareness within digital natives on how to read, create, and learn digitally will make students more successful now and in the future (Wilson et al., 2015). While technical skills are important, many soft skills learned through online communication and work are vital. As such, students and adults must understand their rights and responsibilities when working in the online world (Atif & Chou, 2018). These rights and responsibilities are often called digital citizenship and cover understanding and respecting one's own rights and those others, protecting

intellectual property, refraining from cyberbullying, etiquette, and online safety (Kim & Choi, 2018).

Mirroring studies that state digital natives cannot be assumed to be digitally literate (Calvani et al., 2012; Digby & Bey, 2014; Gross & Latham, 2012; Ng, 2012a, 2012b; Scolari, 2019; van Duerson & van Dijk 2012), it also cannot be assumed that digital natives understand what it means to be a good digital citizen. Kim and Choi (2018) developed the new S.A.F.E. framework for digital citizenship to help teachers address this topic:

- Self-identity- understanding one's own values and beliefs and protecting them in a digital environment
- Activity online- only engaging in positive and reasonable activity online and only interacting with rational decision makers
- Fluency in digital environments- knowing how to use software and hardware to achieve goals and being able to keep up with software and hardware changes
- Ethics in digital environments- understanding and respecting the rights of others

The S.A.F.E. framework was based on International Society for Technology in Education (ISTE) 2016 standards and derived by teachers. Teachers, who need clear criteria for facilitating this learning in the classroom, understand that online dangers are present and through the teaching of digital literacy, digital citizenship became a needed topic. In a world where online culture and traditional culture coexist and often have blurred defining lines, it is crucial that our youth understand these changes and how to maximize the positive effects while minimizing the negative (Kim & Choi, 2018).

In addition to being a good digital citizen, being digitally critical is also a life skill (ALA, 2013). Using digital skills requires individuals to be aware of authenticity and be able to critique

Internet sources and understand what is true and what is not (Ng, 2012b). Critical literacy is often used when helping students understand the overwhelming amount of available information. It has been a term used within English classrooms for years with one aspect being that students are taught not only to explore text but to also question and challenge assumptions or biases within it (Norris et al., 2012).

Inside the field of digital literacy, users of technology need to decipher and question what is shared in the online environment. Using technology appropriately to search, retrieve, and judge the quality of information is essential to being digitally literate and properly informed (ALA, 2013). The importance of critical literacy was further emphasized by Cordell (2013) when stated that to function in today's open society, critical literacy must be a requirement for all. As Cordell states: Americans, value their rights of freedom of speech and access to information, however, must be able to differentiate satire from fact and scams from authentic offers.

Finally, a valued life skill of the online environment is one referred to as online etiquette or netiquette. Netiquette is still a poorly defined term in both research and practice but understanding it is a necessity (Soler-Costa et al., 2021). Luic and Lepoglavec (2019) described netiquette as the opposite of cyberbullying. In a world where communication has changed drastically due to technology, there is an online reality in which cyberbullying, hate, and fake news thrive. Though the systematic literature review completed by Soler-Costa et al. (2021) revealed this line of study is still in its initial phase. It also revealed that training of both students and teachers is critical.

Netiquette is not only valued from the perspective of the student but also that of the school system. Cyberbullying is increasingly becoming a public relations and discipline problem for school systems across the United States. Better training of the basic concepts of

cyberbullying and netiquette are key for school systems, teachers, and students to stay out of the spotlight. Schools must raise awareness of appropriate online behavior and the downfalls of digital hate speech and violence (Luic & Lepoglavec, 2019). Studies conclude that the starting point in teaching netiquette begins with proper modeling from school systems and teachers (e.g., Martin et al., 2019, Soler-Costa et al., 2021, Luic & Lepoglavec 2019). Clear rules, open discussions, and proper modeling early help students to develop and understand this life skill.

Developing Digital Literacy

Over time, teachers of all grade levels have found value in using web-based resources such as Google Docs, Wikis, and YouTube to cover content and engage students. However, students do not naturally learn in these environments and though many have been exposed to these resources, few are familiar with them in the context of education (Cordell, 2013). The desire to use these new learning environments is great but students must be taught how to navigate and be able to create within them. Students and young adults must be taught how to learn in these environments which in turn will teach them how to live in a digital environment.

Young adults do not use educational technologies unless they are exposed to them within the classroom (Ng, 2012b). In a peer-driven world that uses technology solely within a social and entertainment setting, it is unlikely that any digital native would on their own seek out and explore technology in either the professional or educational setting. The same way students are taught tools such as how to use a pencil, they must also be taught how to use technology.

After understanding the need for these skills, the next step is to understand how to develop them. In the past, developing digital literacy skills was often the job of the librarian or computer literacy teacher at the secondary level (Cordell, 2013). However, this method did not allow students to understand the complexity of digital skills and how they are used within

multiple discipline areas. These digital courses, such as Computer Applications, also focused solely on technical skills often leaving out important cognitive components (Ng, 2012b).

Online learning growth in the postsecondary realm is still expanding, even as students within those courses continue to struggle (Hart et al., 2019). As postsecondary institutions saw the discrepancy in digital skills among incoming students, they began offering computer literacy courses to their incoming Freshmen, often making it a graduation requirement. Research conducted in many states throughout the U.S. (e.g., Streich, 2014; Xu & Jaggers, 2013) consistently found that college students performed worse in virtual courses than in face-to-face courses.

These negative results lead researchers to reflect on how teaching practices at the secondary level could possibly prepare students for postsecondary learning, both online and face-to-face (Streich, 2014; Xu & Jaggers, 2013). The outcomes of online learning are not static as students perform better in the online educational environment as their comfort level develops. In addition to the growth of student comfort and engagement in the online environment, online course development and teaching pedagogies are also changing to create better experiences for these students (Hart et al., 2019).

Exposure in Educational Environments

It is recommended that digital learning should be embedded in all courses K-12. From the perspective of curriculum, it is important to engage students with digital resources therefore strengthening their digital skills in a more natural environment (Henrichson & Coombs, 2014). In this atmosphere, the curriculum guides the technology and integration focuses on the advanced stages of digital literacy, such as create and critique, and moves away from consumption.

Exposing secondary students to the digital environment also improves their digital competencies by engaging them in an online learning management system and teaching self-discipline through self-pacing of the course (Etherington, 2017). The attention that school systems are giving to online learning at the secondary level further shows its importance. They also recognize that online learning is necessary for all students, not just those going onto postsecondary schooling.

Henrichson and Coombs (2014) stated that advanced digital literacy skills are not going to develop naturally as a result of access to technology. Educators must be the ones who curate it and teach its proper use. Yet, in an environment in which educators are inundated with curriculum and longing for resources, this becomes an issue. The gaps between digital skills the students have and what they need to succeed in a formal environment is great and therefore becomes another obstacle teachers must overcome.

Pedagogical Digital Competence

Pedagogical Digital Competence (PDC) theory is the ability to improve pedagogy and, therefore, student outcomes through digital technology (From, 2017). PDC is a combination of pedagogical competence theory and digital competence theory. This theory highlights the importance of mindset from both the teacher and student perspectives. The foundation of PDC is on teacher competence yet extends out to teaching this competence through modeling of technology within the classroom and in online environments.

One path that school systems and some states have taken is to mandate that all students take at least one online course before graduation. Currently, Michigan, Florida, Arkansas, Virginia, and Alabama require online credit before graduation (Etherington, 2017). Through online learning, students have more access to courses at a greatly reduced cost. This is especially

beneficial to school systems and students in rural areas (Bakia et al., 2012). Students can make up or get ahead in credits by taking online courses and dual enrollment and Advanced Placement courses give students access to more postsecondary options, therefore, lessening the costs of their postsecondary career.

Digital Literacy in Rural America

To keep students on-track, educators not only need to develop math and reading skills, they also need to develop 21st century skills that prepare students with the knowledge needed for tomorrow (Wilson et al., 2015). Digital literacy is embedded into a student's daily life, from social media, to playing, to learning (Ito et al., 2008). This has caused a tremendous shift in communications and in what is perceived to be literate. Schools are challenged with this, and it is especially important in rural settings where information access is more limited than urban settings.

Advocates for rural education often cite technology as a driving force to better education and therefore economic activity (Gemin et al., 2018). More than half of all districts in the United States are considered rural which makes up 24% of students. The NAEP showed rural students perform on average or better than national averages on mathematics and literacy exams (The Rural School and Community Trust, 2017). However, the national average of 18-24 year olds who enroll in postsecondary is 42% and the average for rural is 29% (NCES, 2015). Gemin et al. (2018) listed causes of this disconnect which include:

- Higher socio-economic disadvantage student populations
- Lower teacher pay
- Declining enrollments
- Fewer teachers trained to teach higher level courses

- Fewer courses available to students
- Lack of digital devices and Internet access at the home

Almost half of rural districts do not offer Advanced Placement (AP) courses to their students. This is a great disadvantage as only 5% of suburban school districts do not offer AP courses (Gemin et al., 2018). This lack of higher-level course offerings, compounded with a lack of digital literacy skills due to little or no exposure to technology, bars many rural students from postsecondary success. States, including Tennessee, are working to close this gap by supporting online programs and online consortia in their state. Nevertheless, success will not happen without the digital skills needed to operate in the online environment.

Teaching Digital Literacy

Multiple studies state it is the task of teachers to develop awareness of educational and professional technologies that students can use both inside and outside the classroom (Calvani et al., 2012; Cordell, 2013; Kim & Choi, 2018; Ng, 2012a; Wilson et al., 2015). With the importance of digital literacy, this may seem overwhelming and nothing more than another addition to the long list of teacher responsibilities. However, it is important to note that students can learn quickly with just basic introductions to unfamiliar technologies (Ng, 2012b). Ng discussed a heightened awareness of technology among digital natives and though they were not digitally literate, their ability to "tinker" with technology helped them to learn quickly.

Overwhelmingly, the lack of digital literacy holds people back from better educating themselves, therefore, holding them back from many job opportunities (Mamedova & Pawlowski, 2018). This lack of access to education due to the lack of digital literacy is a foundation of further concurrent economic issues that result in lower wages and underemployment of those lacking digital literacy skills (Bejakovic & Mrnjavac, 2020). Calvani

et al. (2019) also note that as technology continues to increase, income inequality among workers will further grow. Changes in educational practices in the U.S. are the only way to ensure that students and adults have all the skills, including digital skills, to be competitive in the world (Cummins et al., 2019).

By modeling appropriate use of technology, educators can raise awareness of the tools that can be used for learning. Ng (2012a) discovered that students were able to learn new technology with just a brief introduction by the instructor. After this introduction, students were able to create with the new software comfortably. All frameworks for developing digital literacy rely on blending it into the curriculum. No longer should a media specialist be teaching just the keystrokes, but teachers should be molding it into their courses to show online resources and learning opportunities across the curriculum.

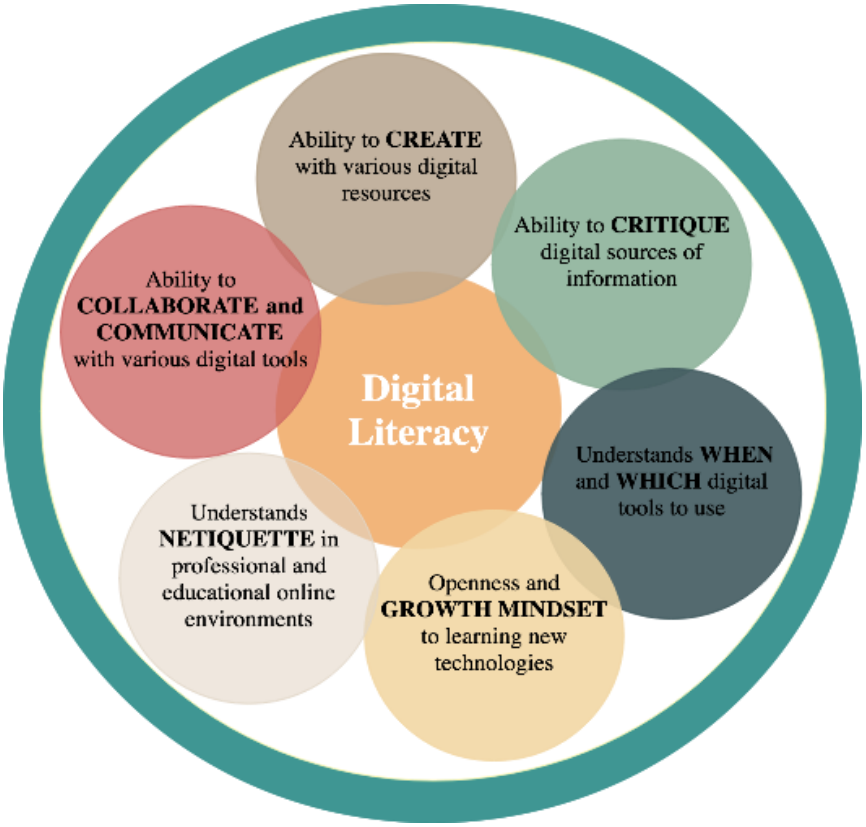
Wilson et al. (2015) learned that students tend to see advantages with the use of technology in education but also understood that it could cause distractions. Student digital literacy is a direct reflection of the computer skills and competencies of their teachers (Nawaz & Kundi, 2010). The opportunity for teachers to model healthy use of technology is key but cannot take place unless schools provide teachers with the needed tools and professional development to integrate technology properly. First steps for school systems should be not only assessing the digital deficiencies of their students but also those of the faculty. By meeting the needs of the faculty first, administrators can develop a strong team that can meet the needs of the students. Digital literacy will not be developed naturally by digital natives; therefore, it is crucial that school systems find ways to mold it into daily learning (Hinrichsen & Coombs, 2014).

The most effective educational environment for most students is where they are face-to-face with a highly engaging, effective teacher (Hart et al., 2019). Gemin et al. (2018) stressed

that technology will never be a replacement for teachers or mentors but a means to extend their abilities. Research by Bejakovic and Mrnjavac (2020) concluded that the development of digital literacy contributes to the knowledge base of society. Training in digital literacy gives learners the ability to not only gain technical skills but also develop competencies that will help them throughout life and career. Figure 6 represents a synthesis of the aforementioned theories and studies.

Figure 6

Characteristics of Digitally Literate Students



Adapted from ICT and digital literacy definitions of ETS, (2002), Hague & Payton, (2010), and Ng, (2012a).

Chapter Summary

One of the great divides between people in the U.S. is grounded in digital skills, those who have them and those who do not (Mamedova & Pawlowski, 2018). Ignorance of such an important life skill will continue to be a barrier to employment and promotion for many (Bergson-Shilcock, 2020). These barriers to learning create a cycle that holds back millions of Americans (Bejakovic & Mrnjavac, 2020). Toffler (1970) wrote, the illiterate of today are not necessarily those who cannot read or write but those who cannot learn, unlearn, and relearn. When teachers can teach students how to learn, unlearn, and relearn with the tools of today, it sets them up for a lifetime of success (Ng 2012; Wilson et al., 2015).

This chapter served to gather past literature that explains the problem, provides explanation of past research, and assembles supporting evidence that addresses the research questions and phenomenon. Chapter 3 will provide a summary of the methodology used within this quantitative study. It will also summarize the data, population, instrument, and the processes of statistical analysis.

Chapter 3. Methodology

The purpose of this study was to determine if students who take an online, asynchronous course better their digital literacy through the experience and environment of online learning. This quantitative study aimed to determine if there is significant growth in students' digital literacy skills who complete an online course while in high school. This study reviewed survey data from Niswonger Online students to determine whether there was a significant difference in digital literacy scores before and after the online course. This non-experimental study was conducted to measure possible relationships of the independent variable, completion of an online course, and the dependent variable, increase in digital literacy.

Research Questions and Null Hypotheses

This research tested the hypothesis: There is a positive relationship between students who take Niswonger Online courses and growth in their digital literacy scores. A digital literacy pretest and posttest was used to evaluate students' digital skills and tested the following:

RQ_1: Is there a significant relationship between students' attitudes towards online learning and digital literacy pretest scores when starting an online course?

$H_0 1$: There is no significant relationship between students' attitudes towards online learning and digital literacy pretest scores when starting an online course.

RQ_2: Is there a significant difference in digital literacy pretest scores between students who attend small high schools (population less than 1200) and students who attend large high schools (population greater than 1200)?

$H_0 2$: There is no significant difference in digital literacy pretest scores between students who attend small high schools (population less than 1200) and students who attend large high schools (population greater than 1200).

RQ_3: Is there a significant difference in digital literacy pretest scores between students who attend rural high schools and students who attend urban or suburban high schools?

$H_0$3: There is no significant difference in digital literacy pretest scores between students who attend rural high schools and those that attend urban or urban or suburban high schools.

RQ_4: Are there any significant differences in the digital literacy pretest scores among grade levels (Freshman, Sophomore, Junior, Senior)?

$H_0$4: There are no significant differences in digital literacy pretest scores among grade levels (Freshman, Sophomore, Junior, Senior).

RQ_5: Are there any significant differences in the growth of digital literacy among courses taken? (Career and Technical, English Language Arts, Math, Social Studies, Science, World Languages, Fine Arts)?

$H_0$5: There are no significant differences between students' digital literacy growth among courses taken. (Career and Technical, English Language Arts, Math, Social Studies, Science, World Languages, Fine Arts)

RQ_6: Is there a significant difference between students' digital literacy before and after taking a Niswonger online asynchronous course?

$H_0$6: There is no significant difference between students' digital literacy before and after taking a Niswonger online asynchronous course.

Population

The population of this study was Tennessee secondary students, grades 9-12, who enrolled in a Niswonger Online course in the spring and summer of 2021. These students were enrolled in high school General Education courses from all subject areas.

All students took online courses through Niswonger Online. Niswonger Online is a division of the Niswonger Foundation, a non-profit education foundation located in Greeneville, TN. The foundation was established in 2001 to create sustainable opportunities for students and communities in east Tennessee (*About Niswonger Foundation*, 2021). In 2011, Niswonger Online was developed as a supplemental online course provider. In its first year, the online program served 30 high schools within northeast Tennessee offering 10 fully online, asynchronous courses (*History of Niswonger Online*, 2016). As of the fall of 2021, Niswonger Online was serving students across the state in 105 school districts, offering over 60 online courses.

Niswonger Online students attend public high schools within the state of Tennessee. Students took Niswonger Online courses to supplement course offerings at their local brick and mortar school. The student's high school counselor or administrator was required to approve their enrollment before taking an online course. Each high school has its own policies regarding what students qualify to take a Niswonger Online course.

The provided data were pulled from two semesters which included students that represented 48 public high schools across the state. These high schools varied in size and location. Figures 7, 8, 9, and 10 illustrate the population of this study with regards to location, grade level, school size, and subject areas of online courses.

Figure 7

Enrollment by Rural and Urban or Suburban School Systems

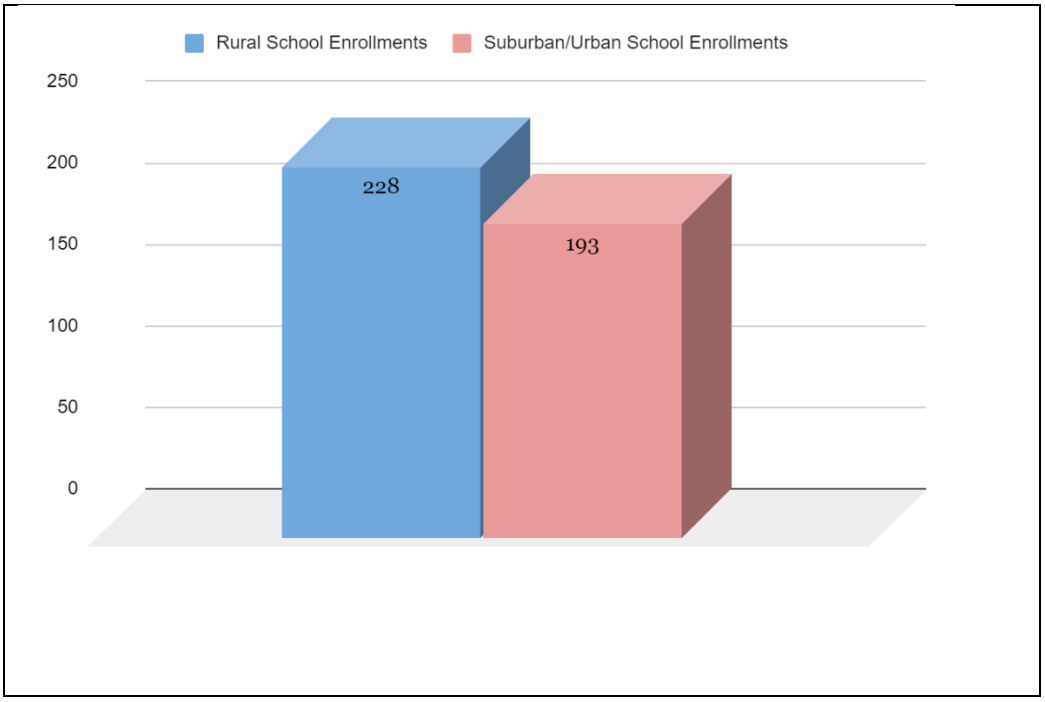


Figure 8

Enrollment by Grade Level

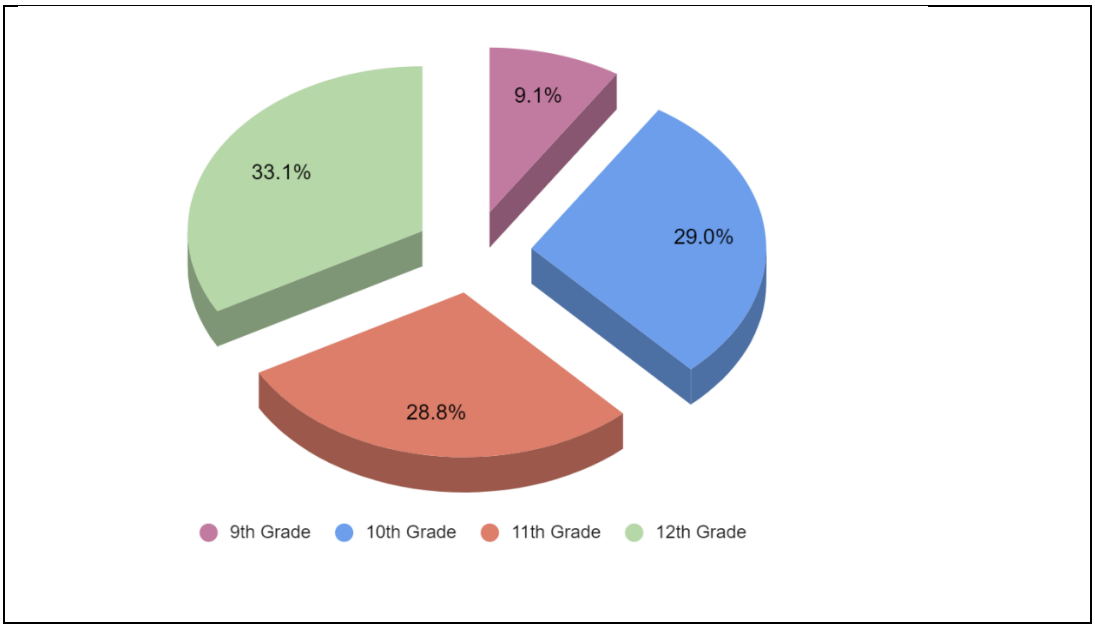


Figure 9

Enrollment by School Size

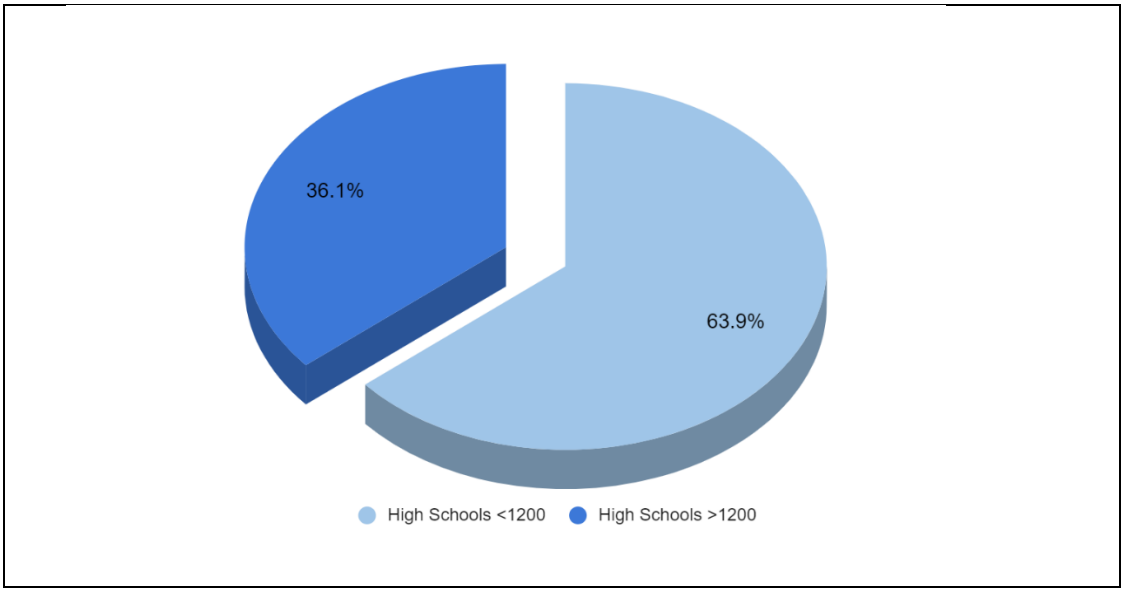
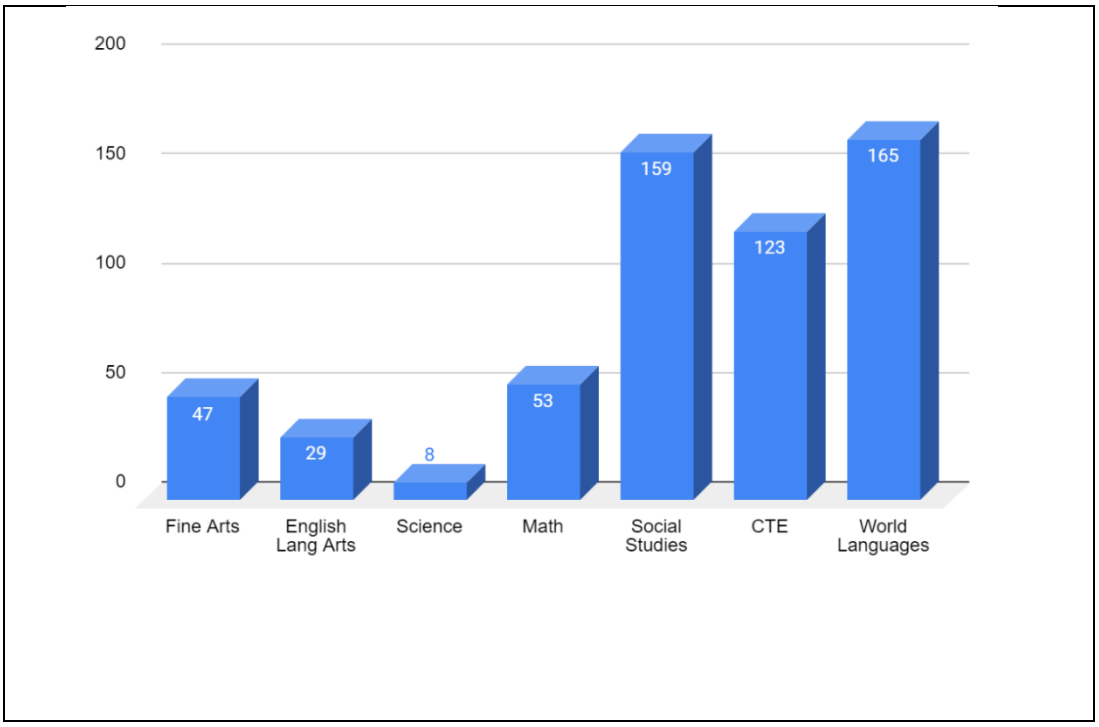


Figure 10

Enrollment by Subject Area



Instrumentation

The administrators of Niswonger Online have surveyed online students for years to gain insight into what skills they have, what they hope to gain from the online course, and overall feedback of their teacher and the course layout. The information gained from these surveys guides decision making for program improvement and expansion.

The survey questions regarding digital literacy were based on two digital literacy assessment instruments: The Digital Competence Wheel (Skov, 2016) and Digital Readiness (Horrigan, 2016). Before the survey responses were used for this study, the survey questions were reviewed by a panel of experts. This panel included a Secondary Supervisor, a secondary Instructional Technology Coach, two secondary classroom and online high school teachers, and an undergraduate online professor.

The survey items consisted of multiple choice, True/False, and Yes/No choices. The posttest contained three open ended questions for students to give feedback and reflection on their experience. This study focused on the 25 assessment questions that could be scored as correct or incorrect to assess their understanding of digital literacy in five areas: Access, Manage, Integrate, Evaluate, and Create (ETS, 2002).

The pretest and posttest each consisted of 32 items total, 25 items assessing their skills in digital technology and 12 items regarding their mindset or self-efficacy towards online learning, past experiences, online course(s) they are currently taking, and high school they attend. Students could not see which questions they missed, nor could they see correct answers after the pretest and posttest surveys were submitted.

The 25 skillset questions of both the pretest and posttest were the same in wording and layout. Variations in pretest and posttest questioning only existed among mindset questions such

as “Are you excited about taking an online course?” (Pretest question) and “Do you feel your technology skills have improved after taking a Niswonger Online course this semester?” (Posttest question). The full instrument can be found in Appendix A.

A score of 18 or higher was set as a passing score for the pretest and posttest instrument. At the level of 18/25 or higher the student is earning 72% or higher on the test. At the level of 17/25 or lower the student is earning 68% or less on the test and therefore failing. This aligns with national and statewide instruments that the administrators of the Niswonger Online program used to develop this survey. The Digital Competence Wheel (Skov, 2016) and Digital Readiness (Horrigan, 2016) both align their instruments to have a pass/fail cutoff of 70%.

Data Collection

Preceding data collection, a proposal of this research was presented to East Tennessee State University’s International Review Board (IRB) for approval. Also, before the data were shared, all identifiable student information given within the survey was removed. Data were collected through surveys given at the beginning of the semester (pretest) and end of the semester (posttest). These surveys were linked within the online courses for easy access by the students. The surveys were housed in a Google Form that was embedded into all General Education Niswonger Online courses. The first form (pretest) was embedded within the first module of the course. The second form (posttest) was embedded into the final module. This survey was not graded and was not a requirement, but students were encouraged to complete it by both their teachers and online administrators.

Data Analysis

For this correlational study, IBM’s Statistical Package for Social Sciences (SPSS) was used. To assess student digital literacy, pretest and posttest scores were used to examine the

following: attitudes towards the online environment and current digital literacy, differences in digital literacy pretest scores in relation to the location of the high school, differences in digital literacy pretest scores in relation to the size of the high school, differences in digital literacy pretest scores among student grade levels, differences in digital literacy growth in relation to the online course taken, and overall digital literacy growth after the online course was completed. All data were analyzed at the .05 level of significance.

More specifically, to examine Research Question 1, a coefficient (r) was completed to assess any relationship between student attitudes towards digital literacy and digital literacy pretest scores. Independent t-tests were used for Research Questions 2 and 3 to assess any significant difference in mean pretest scores between rural and urban or suburban schools and large and small schools. An Analysis of Variance (ANOVA) was completed for Research Question 4 to evaluate significant differences between digital literacy pretest scores among student grade levels (Freshman, Sophomore, Junior, Senior). Research Question 5 was also analyzed using an ANOVA to examine differences in growth of digital literacy scores among the seven different subject areas (Career and Technical, English Language Arts, Math, Social Studies, Science, World Languages, Fine Arts). Finally, for Research Question 6, a paired samples t-test was conducted using pretest and posttest scores to analyze growth after the online course was completed.

Chapter Summary

The goal of this chapter was to outline the methods used to address the six research questions of this study. A explanation of the population, instrumentation, data, and data analysis were given. Using the Niswonger Online student survey, quantitative measures were used to

understand the lack of digital literacy and subsequent growth found after completing an online course. Chapter 4 presents the findings of the statistical analyses.

Chapter 4. Findings

Research has found that digital natives are not always digitally literate (Ng, 2012a). This study examined past literature to find the reasons behind this disconnect and then evaluated digital literacy data of Tennessee high school students before and after taking an online course with Niswonger Online. The goal was to further the understanding of where high school students are regarding digital literacy and how to develop their digital literacy, better preparing them for postsecondary education and career. This nonexperimental study used IBM's SPSS program to analyze the data at a .05 level of significance. The findings are presented in relation to each Research Question and Null Hypothesis.

Research Question 1

Is there a significant relationship between students' attitudes towards online learning and digital literacy pretest scores when starting an online course?

$H_0$1: There is no significant relationship between students' attitudes towards online learning and digital literacy pretest scores when starting an online course.

A Pearson Correlation coefficient was computed to test the relationship between student attitudes towards taking an online course and pretest scores. The results of the analysis revealed a statistically significant correlation [r(291)= .119, p= .043] with a strong positive relationship between students who were excited about taking an online course (M =1.70, SD =.46) and higher pretest scores (M = 17.58, SD = 3.48). As a result of the analysis, the null hypothesis was rejected. These results suggest that, in general, students who have more positive attitudes about taking an online course tend to have higher digital literacy levels before taking the online course than those who have less positive attitudes.

Research Question 2

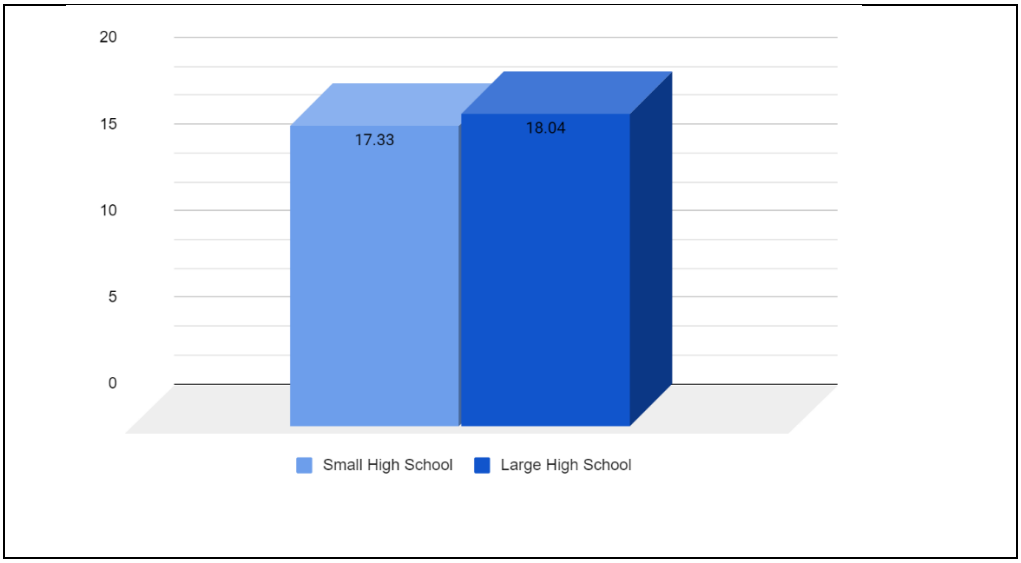
Is there a significant difference between the digital literacy pretest scores of students who attend small high schools (fewer than 1200 students) and those who attend large high schools (greater than 1200 students)?

$H_0$2: There is no significant difference in digital literacy pretest scores between students who attend small high schools (fewer than 1200 students) and students who attend large high schools (greater than 1200 students).

An independent samples t-test was conducted to evaluate whether the mean pretest scores of students at smaller high schools (fewer than 1200) are significantly different than the mean pretest scores of students from larger high schools (greater than 1200). The pretest score was the test variable and the grouping variable was the size of the high school. The test was significant, $t(365) = 2.025$, $p = .044$. Therefore, the null hypothesis was rejected. Levene's Test indicated unequal variances ($F = 6.61$, $p = .01$), subsequently, degrees of freedom were adjusted from 419 to 365. Students from high schools with more than 1200 students ($M = 18.04$, $SD = 3.15$) on average, scored significantly higher on the pretest than students from high schools with fewer than 1200 students ($M = 17.33$, $SD = 3.86$). The 95% confidence interval for the difference in means was .02 to 1.39. The η^2 index was 3.62 which indicated a large effect size. Figure 11 shows the average pretest scores for the two groups.

Figure 11

Average Pretest Scores for Small and Large High Schools



Research Question 3

Is there a significant difference in digital literacy pretest scores between students who attend rural high schools and students who attend urban or suburban high schools?

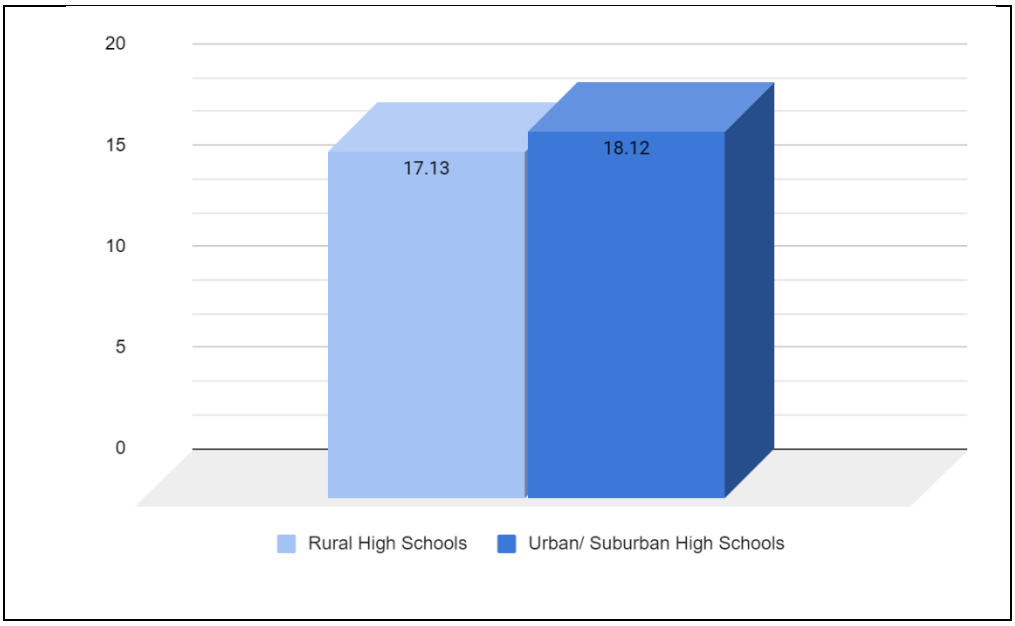
$H_0$3: There is no significant difference in digital literacy pretest scores between students who attend rural high schools and those that attend urban or suburban high schools.

An independent samples t-test was conducted to evaluate whether the mean pretest scores of students at rural high schools are significantly different than the mean pretest scores of students at urban or suburban high schools. The pretest score was the test variable and the grouping variable was the location of the high school. The test was significant, $t(414) = 2.88$, $p = .004$. Therefore, the null hypothesis was rejected. Levene's Test indicated unequal variances ($F = 8.09$, $p = .005$), consequently, degrees of freedom were adjusted from 419 to 414. Students from urban or suburban high schools ($M = 18.12$, $SD = 3.04$) on average, scored significantly

higher on the pretest than students from rural high schools (M = 17.13, SD = 4.02). The 95% confidence interval for the difference in means was .31 to 1.67. The η^2 index was 3.61 which indicated a large effect size. Figure 12 shows the average pretest scores for the two groups.

Figure 12

Average of Pretest Scores for Urban or Suburban and Rural High School Students



Research Question 4

Are there any significant differences in the digital literacy pretest scores among grade levels (Freshman, Sophomore, Junior, Senior)?

$H_0$4: There are no significant differences in digital literacy scores among grade levels (Freshman, Sophomore, Junior, Senior).

An analysis of variance (ANOVA) was conducted to evaluate the difference between students' pretest scores in different grade levels. The factor variable grade level included Freshman, Sophomore, Junior, Senior. The dependent variable was pretest digital literacy scores.

The ANOVA was significant, $F(3, 534) = 9.58$, $p = .001$, therefore, the null hypothesis was rejected.

Because the overall F test was significant, post hoc multiple comparisons were conducted to evaluate pairwise differences among the means of the grade levels. A Tukey procedure was used for the multiple comparisons because equal variances were assumed. There was a significant difference between the means of Sophomores and Freshmen ($p = .042$), Sophomores and Juniors ($p = .001$), and Sophomores and Seniors ($p = .001$). However, there were no significant differences among other grade level pairs. The average pretest scores among grade levels are depicted in Figure 13. Means, standard deviations, and 95% confidence intervals for the grade levels are reported in Table 1.

Figure 13

Average Pretest Scores Among Grade Levels

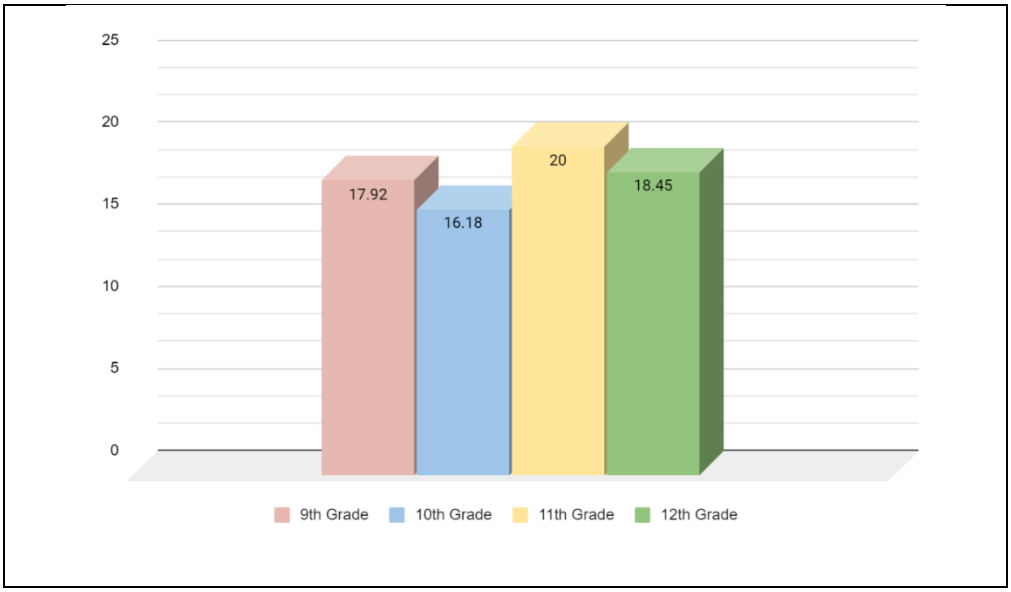


Table 1

Grade Level Pretest Scores

Grade Level	N	M	SD	95% Confidence Interval	
Freshman	38	17.9211	3.88609	16.6437	19.1984
Sophomore	121	16.1818	4.63321	15.3479	17.0158
Junior	120	17.9083	2.91042	17.3823	18.4344
Senior	138	18.4493	2.70731	17.9936	18.905

Research Question 5

Are there any significant differences in digital literacy growth among courses taken? (Career and Technical, English Language Arts, Math, Social Studies, Science, World Languages, Fine Arts)

$H_0$5: There are no significant differences between students' digital literacy growth among courses taken. (Career and Technical, English Language Arts, Math, Social Studies, Science, World Languages, Fine Arts)

An analysis of variance (ANOVA) was conducted to evaluate the difference between growth in digital literacy scores among the online courses taken. The factor variable courses included seven subject areas: Career and Technical, English Language Arts, Math, Social Studies, Science, World Languages, and Fine Arts. The dependent variable was percentage growth in digital literacy scores. The ANOVA was significant, $F(6, 534) = 3.48$, $p = .002$. Therefore, the null hypothesis was rejected. The strength of the relationship between course taken and digital literacy growth, as assessed by Cohen's d was low at $\eta^2 = .038$.

Because the overall F test was significant, post hoc multiple comparisons were conducted to evaluate pairwise differences among the means of the seven subject areas. A Tukey procedure was used for the multiple comparisons because equal variances were assumed. There was a

significant difference between the means of World Languages and Social Studies (p= .004) and World Languages and Career and Technical (p = .007). However, there were no significant differences among other subject areas within the study. Means, standard deviations, and 95% confidence intervals for percentage growth among subject areas are reported in Table 2.

Table 2

Subject Area Percentage Growth

	N	M	SD	95% Confidence Interval	
Fine Arts	46	0.1387	0.1604	0.0911	0.1863
English Language	29	0.1221	0.14244	0.0679	0.1762
Science	8	0.1075	0.09192	0.0306	0.1844
Math	53	0.1236	0.14741	0.083	0.1642
Social Studies	124	0.1043	0.1264	0.0818	0.1267
Career and Technical	116	0.11	0.13297	0.0855	0.1345
World Languages	165	0.3601	1.02184	0.203	0.5171

Research Question 6

Is there a significant difference between students' digital literacy before and after taking a Niswonger Online asynchronous course?

$H_0$7: There is no significant difference between students' digital literacy before and after taking a Niswonger online asynchronous course.

A paired samples t-test was conducted to evaluate whether students' digital literacy scores improved after taking an online course. The results from the pretest (M = 17.66, SD = 3.57) and posttest (M = 19.82, SD = 2.40) indicate that there is a significant difference in digital literacy scores, $t(413) = 11.45$, $p < .001$. Therefore, the null hypothesis was rejected. The 95% confidence interval for the difference in means was 2.53 and 1.79. The η^2 index was 3.83 which indicated a large effect size. On average, students who completed their Niswonger Online course

scored significantly higher on the digital literacy posttest than they scored on the pretest. Figure 14 depicts the percent of students passing the pretest. Figure 15 depicts the percent of students passing the posttest. Figure 16 displays the mean scores of the pretest and posttest for all Niswonger Online students.

Figure 14

Overall Pretest Percentage Pass and Fail

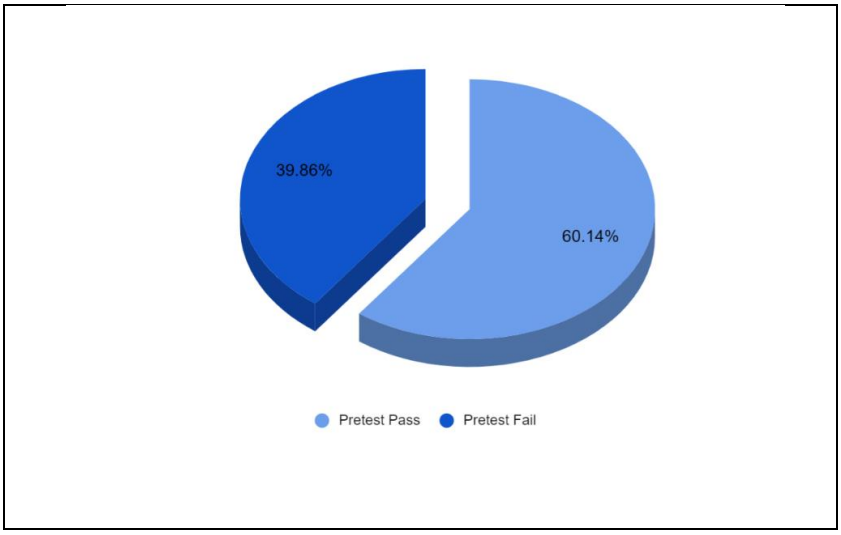


Figure 15

Overall Posttest Percentage Pass and Fail

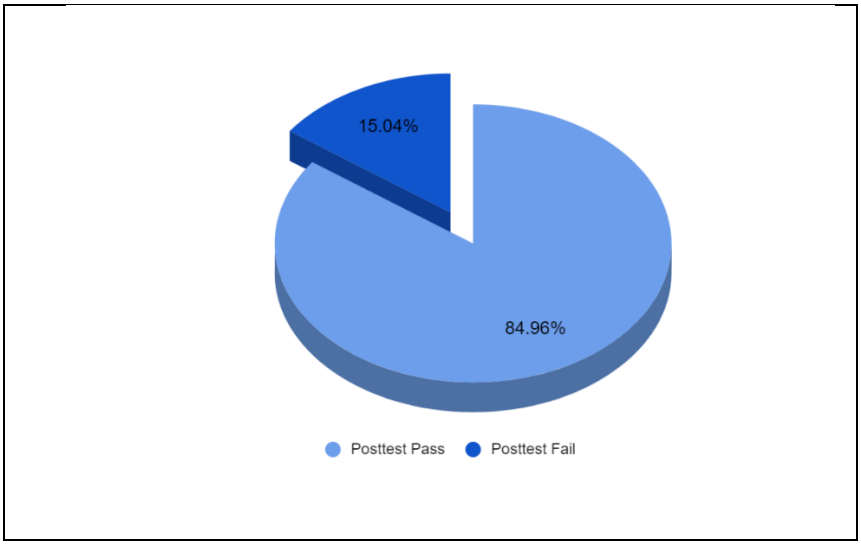
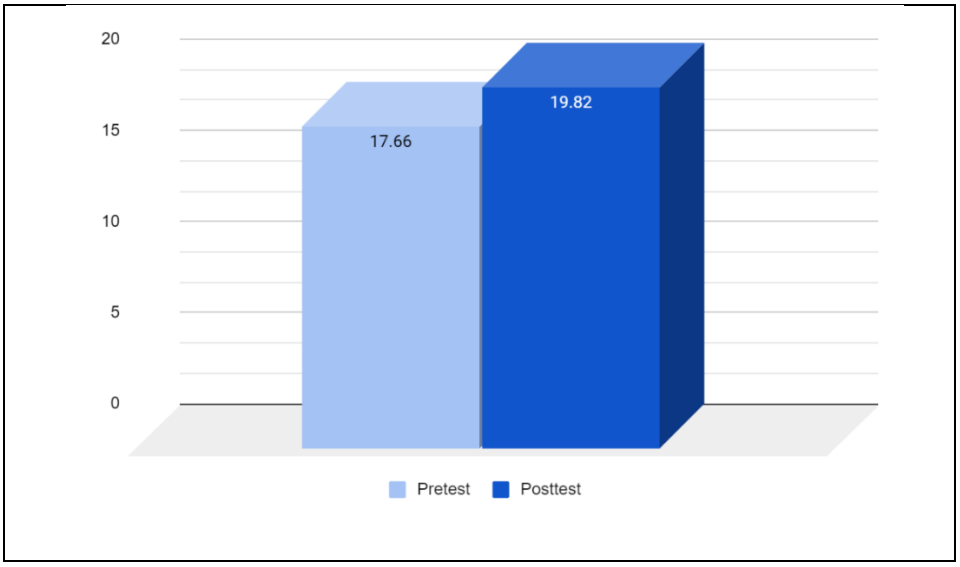


Figure 16

Average of Pretest and Posttest Digital Literacy Scores



Chapter Summary

This chapter presents the statistical analysis of all data in relation to the six research questions and corresponding null hypotheses. All null hypotheses were rejected, which indicated significant differences and relationships. Chapter 5 further discusses the interpretation of these rejections and shares the conclusions, implications for future practice, and recommendations for additional research.

Chapter 5. Summary, Conclusions, and Recommendations

The importance of digital literacy has been established by multiple researchers including Bergson-Shilcock (2020), Cummins et al. (2019), Henrichson and Coombs (2014), and Ng (2012a). The ability to work, communicate, and play are highly dependent on digital skills and the ability to adapt to the ever-changing online environment. Whether a student chooses college or career as their postsecondary path, digital skills will be needed.

Summary of Findings

Research Question 1 focused on student mindset towards online learning by looking at their attitudes towards online learning in relation to their current digital literacy levels (pretest scores). A significant relationship was found with students who had more positive attitudes about taking the online course showing passing scores on the digital literacy test at the start of the course. This aligns with past studies such as Bejakovic and Mrnjavac (2020) and Wilson et al. (2015) and holds great importance in society of the 21st century. Fear of the online environment has deterred many with a lack of digital literacy holding back student learning and inhibiting adults who want to advance their degrees and careers. In an economy that rewards digital literacy, it is always beneficial to make the online environment a space of comfort for all (Hart et al., 2019).

Further analyses of pretest scores showed significant differences between pretest score means in relation to high school size and location. Research Question 2 revealed Niswonger Online students who attended suburban high schools scored significantly higher on the pretest than students from rural high schools. Whereas Research Question 3 showed students from larger high schools (more than 1200 students) scored significantly higher on the pretest than students from smaller high schools. Lack of access to technology outside of the school day for students in

rural and small schools is a hindrance to digital literacy. With rural education supporters operating under the premise that online courses can be the force behind equitable education (Gemin et al., 2018) it is important to understand that rationale only works if students have the access to technology and the skills that are needed to succeed in the online environment.

A final analysis of pretest scores looked at differences among the mean pretest scores of Freshmen, Sophomores, Juniors, and Seniors. The ANOVA post hoc for Research Question 4 showed Sophomores with significantly lower pretest scores than all other grade levels. However, there was no significant difference between Freshmen and Juniors, Freshmen and Seniors, and Juniors and Seniors. This test was important to ascertain starting digital literacy scores among the grade levels. Knowing that sophomores in this study scored significantly lower than all other grade levels can guide future research to identify why there is a gap and which specific skills are lacking.

Research Question 5 used percentage growth to determine differences in student digital literacy growth among the seven subject areas. The strength of the relationship was low; however, after post hoc comparisons it was found that World Languages saw the largest percentage growth in test scores with significant differences among World Languages and Social Studies courses and World Languages and Career and Technical courses. This finding aligns with the findings in Research Question 4 as most of the students in World Language courses were Sophomores. This is significant because it shows that the population with the lowest digital literacy pretest scores (Sophomores) showed the most digital literacy growth. It also showed overall growth among all subject areas which aligns with past studies that stated students can obtain the digital literacy skills needed through exposure and use of online digital resources

within most courses, even those not specifically geared towards the learning of technological tools (Bergson-Shilcock, 2020; Calvani et al., 2012; Ng, 2012b).

The last analysis involved overall growth among the entire population of students between the pretest and posttest. Research Question 6 analyzed this and found a significant growth between the mean pretest and posttest scores. This finding again aligns with past research (e.g., Bergson-Shilcock, 2020 and Ng, 2012b) and furthers the concept that students can become digitally literate when exposed to educational and professional digital tools.

Discussion

The purpose of this study was to gain insight into the digital literacy levels of high school students within the state of Tennessee. Through a pretest and corresponding posttest placed within a Niswonger Online course, students' initial digital literacy levels and growth were statistically analyzed. The data revealed significant differences in pretest scores among different populations of high school students within Tennessee. This study also revealed that, on average, students who completed an online course with Niswonger Online saw significant growth in their digital literacy. Numerous studies support the findings of this research, (Bergson-Shilcock, 2020; Calvani et al., 2012; Digby & Bey, 2014; Ng, 2012a, 2012b; Scolari, 2019; van Duerson & van Dijk 2012), which conclude that digital literacy skills are lacking among certain populations and that digital natives can quickly become digitally literate when exposed to technology in an educational environment.

Within this study, on average, students from urban or suburban schools and students from larger high schools scored higher on the pretest. It also revealed that, on average, students who complete an online course, any subject area, gain digital literacy skills through the experience of online learning. This is important as K-12 and postsecondary institutions continue to grow online

learning platforms (Hart et al., 2019) and as the labor force of the U.S. economy needs these skills to continue economic sustainability and growth (Mamedova & Pawlowski, 2018).

Recommendations for Future Research

To better understand the implications of this research, an experimental study using students who have never taken an online course (control group) in relation to students who have taken an online course (experimental group) should be completed. Also, an instrument created specifically for this type of research, such as the Digital Competence Wheel (Skov, 2016) or Digital Readiness (Horrigan, 2016) evaluation, should be used to further this study with data specific to assessing digital literacy.

An additional area for exploration involves the Dunning-Kruger (2011) effect. Chapter 2 discussed this phenomenon which states that a person does not know their own ignorance. This often leads to a self-inflated view of skills versus actual skills. The data from this survey showed that 88% of the students identified themselves as being digitally literate within the pretest. However, only 60% of the students passed the digital literacy pretest. Therefore, additional research, quantitative or qualitative, would better the understanding of student mindset and actual skillset hence improving decision making within the field.

The use of technology among the administration and leadership of rural school systems is often behind that of other urban or suburban systems. A qualitative study revealing insight into why this variation exists would better this field of study and assist with future policy actions in rural areas. This would also further knowledge in regards to the student body by allowing an examination of possible relationships between adult technology use at schools and the digital literacy of their students.

An action research study should also be completed to better understand the significant growth within the World Language courses. A look at the programs and applications used in those courses and the projects or assessments assigned could better development of future courses in all subject areas. Finally, the full population of Niswonger Online students was not studied in this research because not all students who started the online course completed it. A qualitative study focusing on the reasoning behind students' failure of or withdrawal from an online course is recommended to provide a better understanding of specific digital literacy skills lacking among digital natives.

Recommendations for Implementation

Based on the conclusions within this study, it is proposed that education practitioners and leaders not only educate themselves on the imbalance of digital literacy levels among digital natives but also understand the importance of growing this skill set. Having skills of programming, applications, online safety, and online communication are no longer reserved for those who major in the field of Computer Sciences. These skills are needed in some degree by all contributing members of society.

With the knowledge of this research, educational administrators and policymakers now have the responsibility to further this field of study and address current practices. It is recommended that practitioners and leaders create effective ways to develop digital literacy among all high school students to better prepare them for college and career paths. Ng's research (2012b) supports the findings of this study that students do not need a separate digital literacy course to grow the technology skills needed. Students only need to use the technology in an educational setting. By teaching students how to learn with the tools of today, they are better prepared for tomorrow (Wilson et al., 2015).

Conclusion

Further experimental research is necessary to determine the full effect of online learning on digital literacy; however, the significant findings of this study show that new course mandates do not have to be placed on high school students to learn needed digital skills. This research found disparities in digital literacy based on students' high school location and size. Students in Tennessee who attend small high schools or rural high schools are being left behind. These factors are often outside the control of students and families and therefore action must be taken by educational leaders to reduce these inequities.

In a world that rewards technology skills, experiences within the online environment and online learning are essential (Hart et al., 2019). The ability to learn both inside and outside the classroom is in high demand in the 21st century. This is across all job levels and fields and the skill to be able to educate oneself, even outside of formal educational environments, will ensure the U.S. workforce is able to adapt and fill future jobs (Bejakovic & Mrnjavac, 2020). Through online learning options and purposeful technology use blended within the classroom, students can learn vital technology skills that prepare them to learn in all environments and ready them for their chosen postsecondary path.

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APPENDIX: Pretest and Posttest Survey Questions

What is digital literacy?

"To be digitally literate is to have access to a broad range of practices and cultural resources you are able to apply to digital tools. It is the ability to make and share meaning in different modes and formats; to create, collaborate, and communicate effectively, and to understand how and when digital technologies can best be used to support these processes." (Hague & Payton, 2010, p. 2)

What Niswonger Online course or courses are you taking this semester? *

Your answer

What High School do you attend? *

Your answer

What grade are you in? *

- ○ 8th
- ○ 9th
- ○ 10th
- ○ 11th
- ○ 12th

Have you taken a Niswonger Online Course in the past? *

- ◯ Yes
- ◯ No

If you have previously taken a Niswonger Online course, please list the course or courses below:

Your answer

Do you think you are good with technology- meaning do you feel you are digitally literate? *

- ◯ Yes
- ◯ No

Are you excited about taking an online course? *

- ◯ Yes
- ◯ No

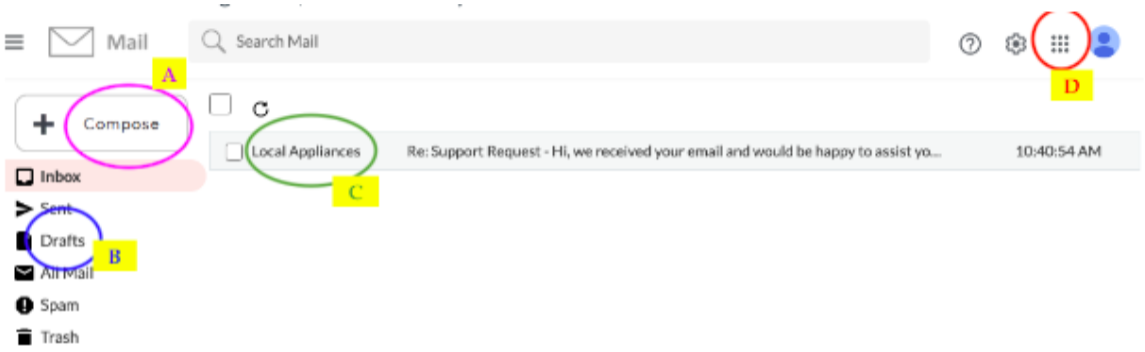
Looking at the keyboard below, which shortcut keys should be pressed to easily paste information into a document? *

- ◯ Ctrl- C
- ◯ Ctrl- P
- ◯ Ctrl-Z
- ◯ Ctrl-V

Looking at the keyboard below, which shortcut keys should be pressed to easily cut information from a document? *

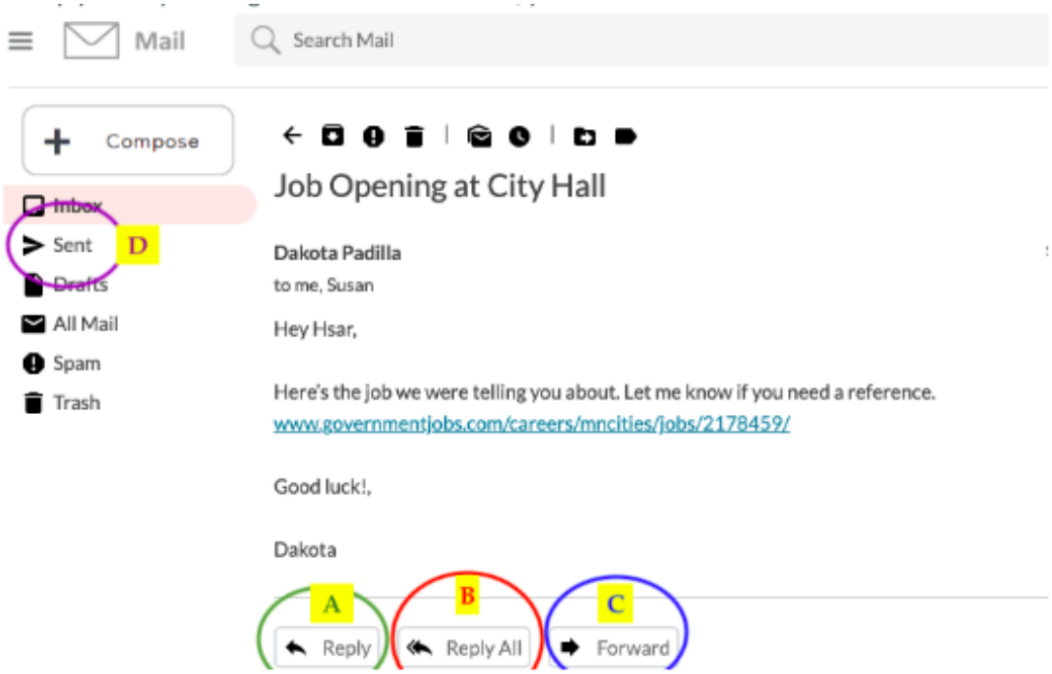
- ◯ Ctrl- C
- ◯ Ctrl- P
- ◯ Ctrl-X
- ◯ Ctrl-Z

To create a new Google Doc, where should you click? *



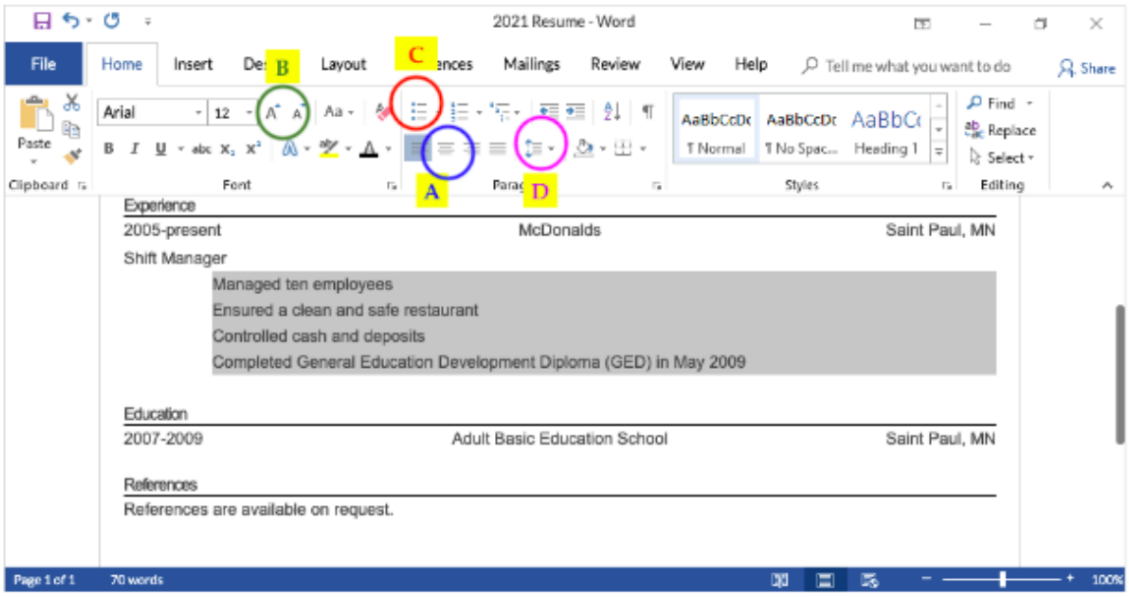
- ○ A
- ○ B
- ○ C
- ○ D

To reply to only the original sender of this email, you should click: *



- ○ A
- ○ B
- ○ C
- ○ D

To add bullets to the highlighted area, where would you click? *

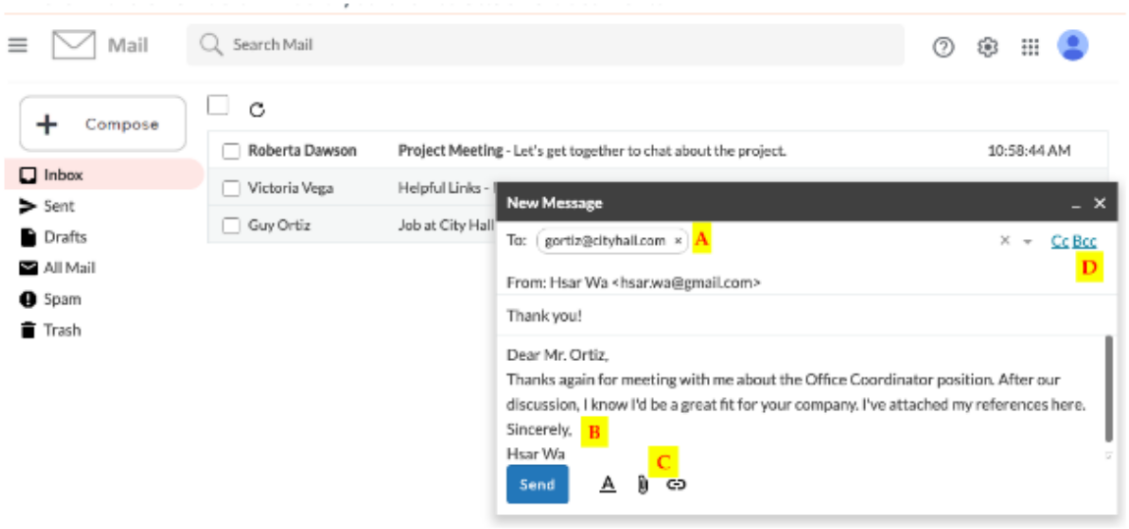


- A
- B
- C
- D

(Choose all that apply) Which icons in the picture open an internet browser: *

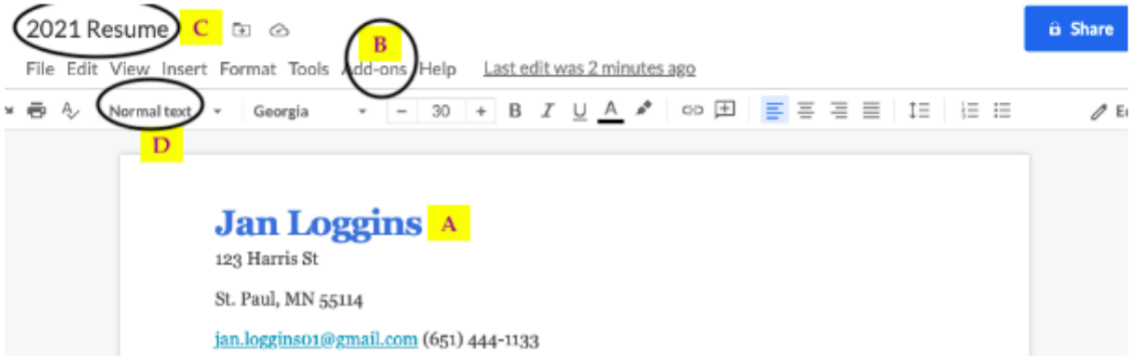
- [ ] A
- [ ] B
- [ ] C
- [ ] D

Where in the email below would you click to attach a document? *



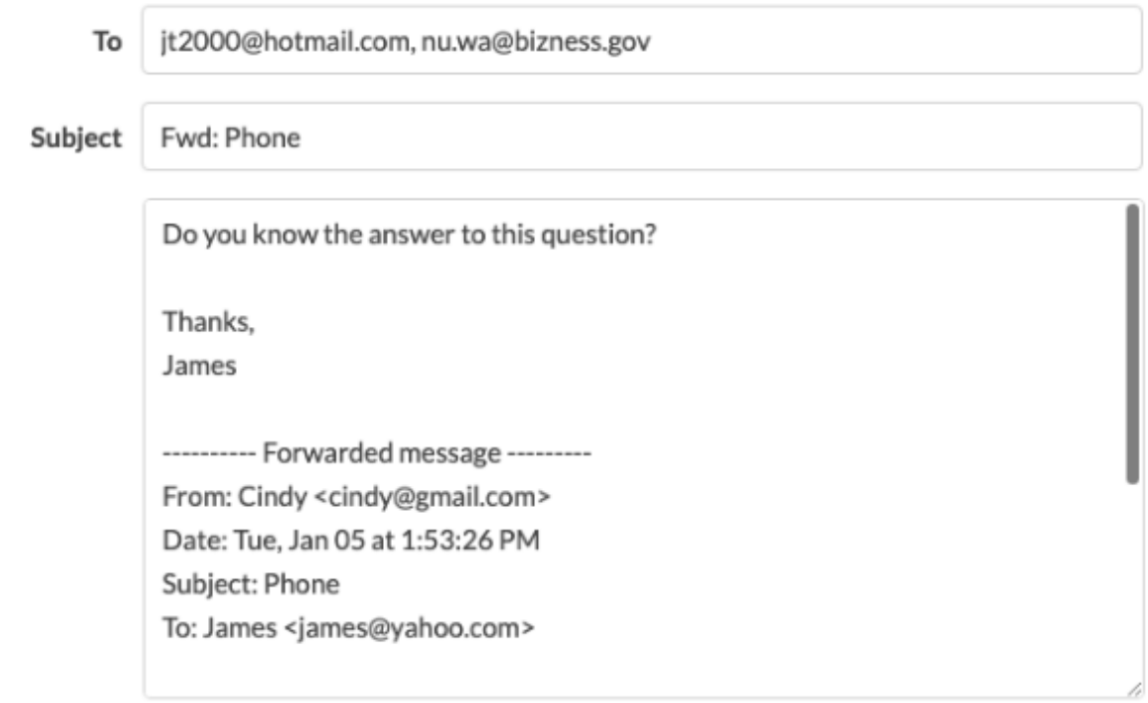
- ◯ A
- ◯ B
- ◯ C
- ◯ D

Where would you click to rename this document? *



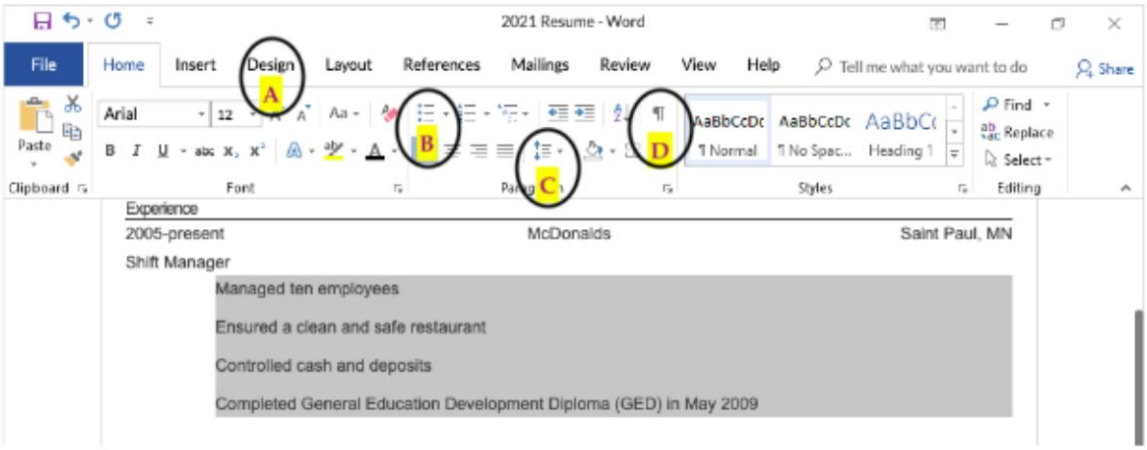
- ◯ Next to the name- Jan Loggins
- ◯ On Add-ons
- ◯ On 2021 Resume
- ◯ On Normal text

(Choose all that apply) The following email is not proper etiquette. What about it is bad etiquette? *



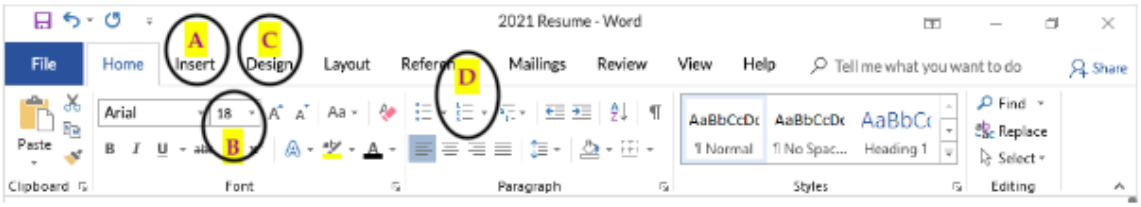
- [ ] It is forwarding suspicious links.
- [ ] It is connecting people to a possible scam email.
- [ ] The subject line is lacking information.
- [ ] The email has no greeting.

Which icon in the toolbar will quickly make your text double or single-spaced? *



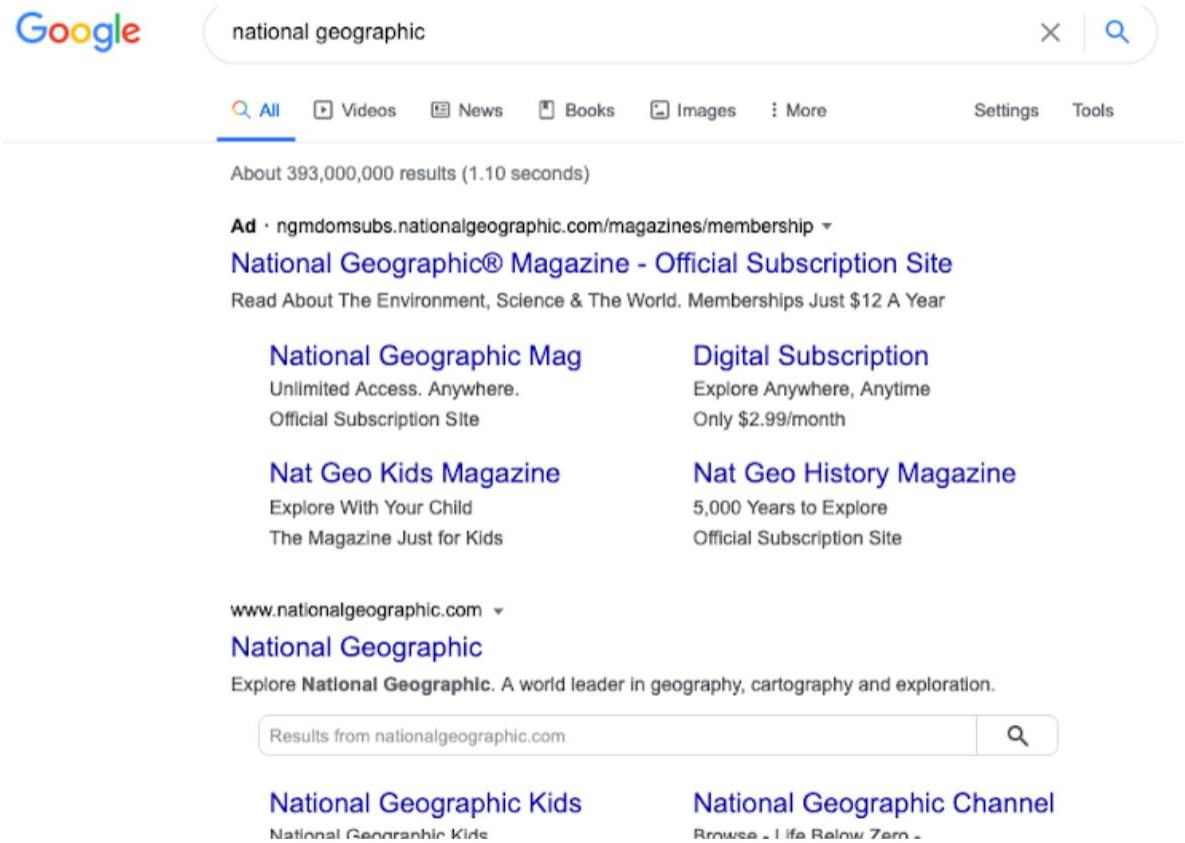
- A
- B
- C
- D

Where would you click to change the font size of highlighted text? *



- A
- B
- C
- D

When National Geographic is Googled, the first web address link listed is that of National Geographic. (See below) *

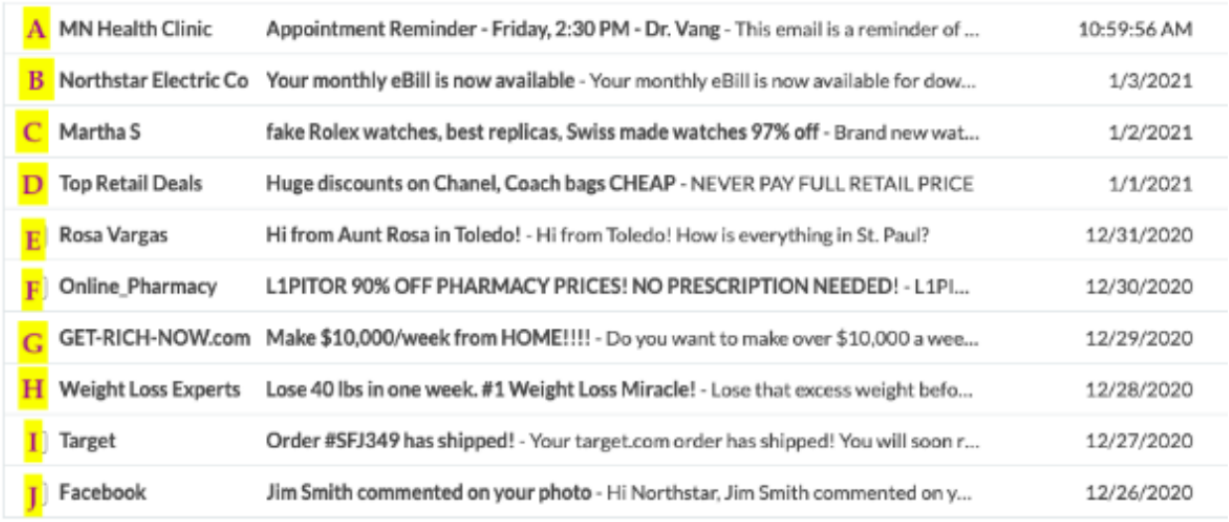


- ◯ True
- ◯ False

If you post an inappropriate picture to social media the only way a person, school, or employer can see it is if they are your "Friends" on that site. *

- ◯ True
- ◯ False

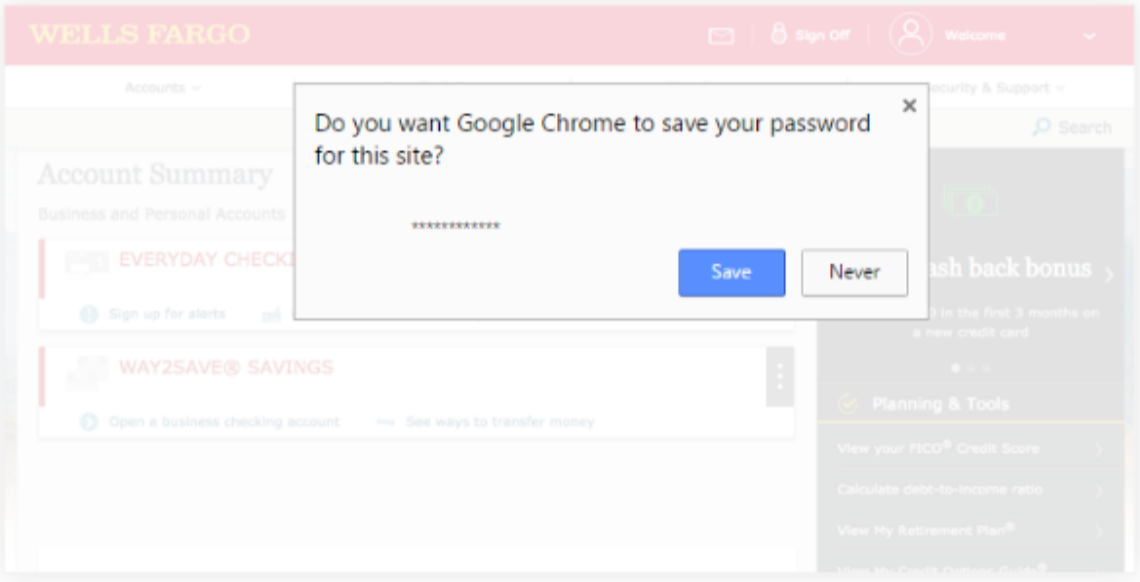
(Choose all that apply) When looking at the subjects of the emails below, which ones are Spam? *



A	MN Health Clinic	**Appointment Reminder - Friday, 2:30 PM - Dr. Vang** - This email is a reminder of ...	10:59:56 AM
B	Northstar Electric Co	**Your monthly eBill is now available** - Your monthly eBill is now available for dow...	1/3/2021
C	Martha S	**fake Rolex watches, best replicas, Swiss made watches 97% off** - Brand new wat...	1/2/2021
D	Top Retail Deals	**Huge discounts on Chanel, Coach bags CHEAP** - NEVER PAY FULL RETAIL PRICE	1/1/2021
E	Rosa Vargas	**Hi from Aunt Rosa in Toledo!** - Hi from Toledo! How is everything in St. Paul?	12/31/2020
F	Online_Pharmacy	**L1PITOR 90% OFF PHARMACY PRICES! NO PRESCRIPTION NEEDED!** - L1PI...	12/30/2020
G	GET-RICH-NOW.com	**Make $10,000/week from HOME!!!!** - Do you want to make over $10,000 a wee...	12/29/2020
H	Weight Loss Experts	**Lose 40 lbs in one week. #1 Weight Loss Miracle!** - Lose that excess weight befo...	12/28/2020
I	Target	**Order #SFJ349 has shipped!** - Your target.com order has shipped! You will soon r...	12/27/2020
J	Facebook	**Jim Smith commented on your photo** - Hi Northstar, Jim Smith commented on y...	12/26/2020

- [ ] A
- [ ] B
- [ ] C
- [ ] D
- [ ] E
- [ ] F
- [ ] G
- [ ] H
- [ ] I
- [ ] J

When logging into your bank account from a school computer, you get the following pop-up. What should you do? *

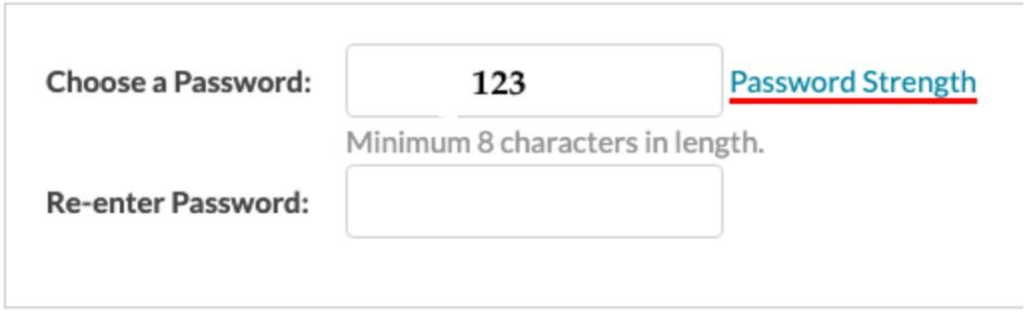


- ◯ Click Save
- ◯ Click Never

Which step below is the best and immediate way to protect and safeguard your online information, social media accounts, and work accounts when working on a computer? *

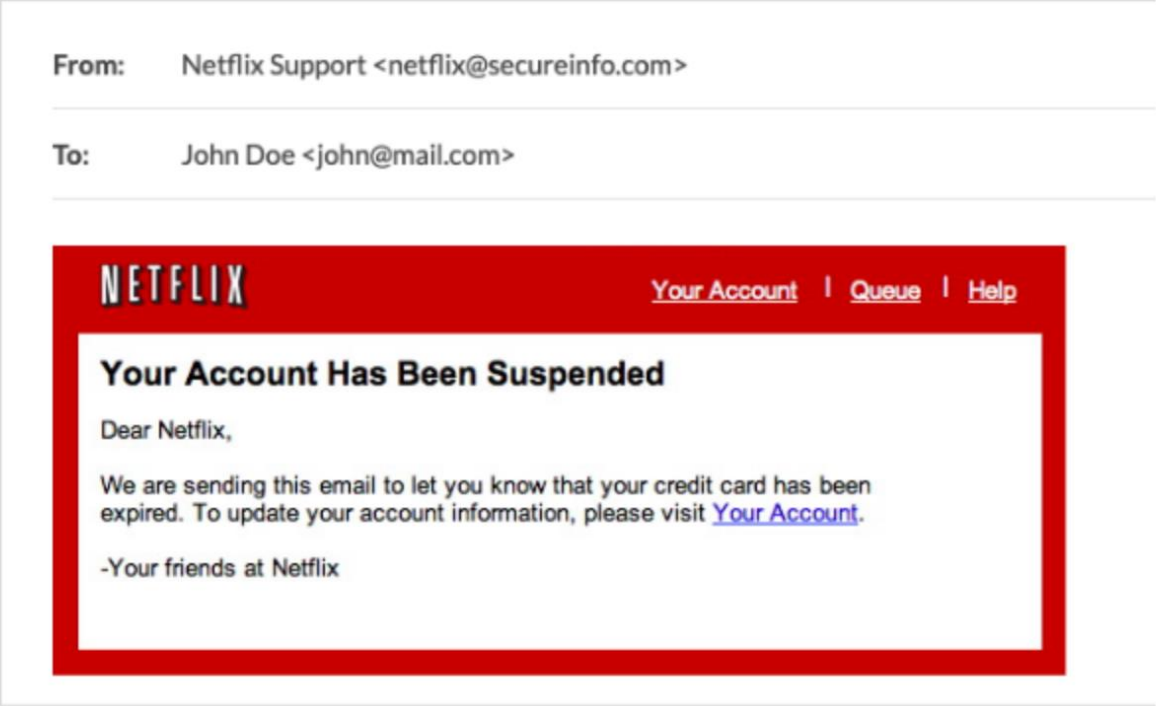
- ◯ Pay for a service to protect your devices and information.
- ◯ Always logout and close all windows when done working.
- ◯ Use easy to remember passwords so you don't forget yours.
- ◯ Always back your information up to the cloud.

(Choose all that apply) What can be done to make this password stronger? *



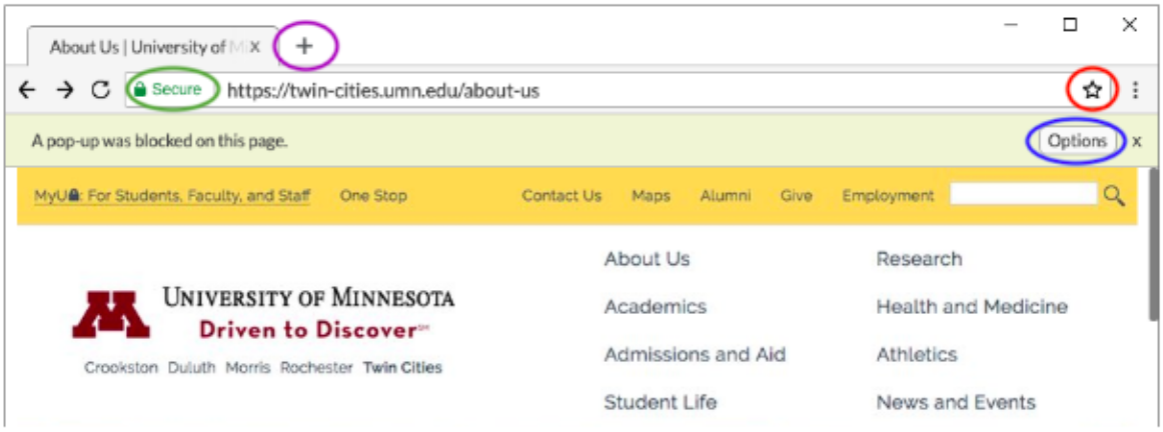
- ☐ Nothing needs to be done. This password is fine.
- ☐ Capital letters can be added
- ☐ Symbols can be added
- ☐ Typing the full name

You receive the email below. What should you do? *



- ◯ Click on the blue hyperlink that says Your Account
- ◯ Click to reply to the message for more infomation
- ◯ Click on Queue
- ◯ Delete the message and log into your Netflix account

Where on this page should you click to change your pop-up settings? *



- ○ + sign (purple circle)
- ○ Secure (green circle)
- ○ Star (red circle)
- ○ Options (blue circle)

(Choose all that apply) Which of the website addresses below are secure and use feasible domain names? *

- [ ] https://amazon.com
- [ ] https://heroes.rf
- [ ] http://newzealand.country
- [ ] http://hotmail.com

Which icon allows you to check WiFi settings. *

- ○ A
- ○ B
- ○ C
- ○ D

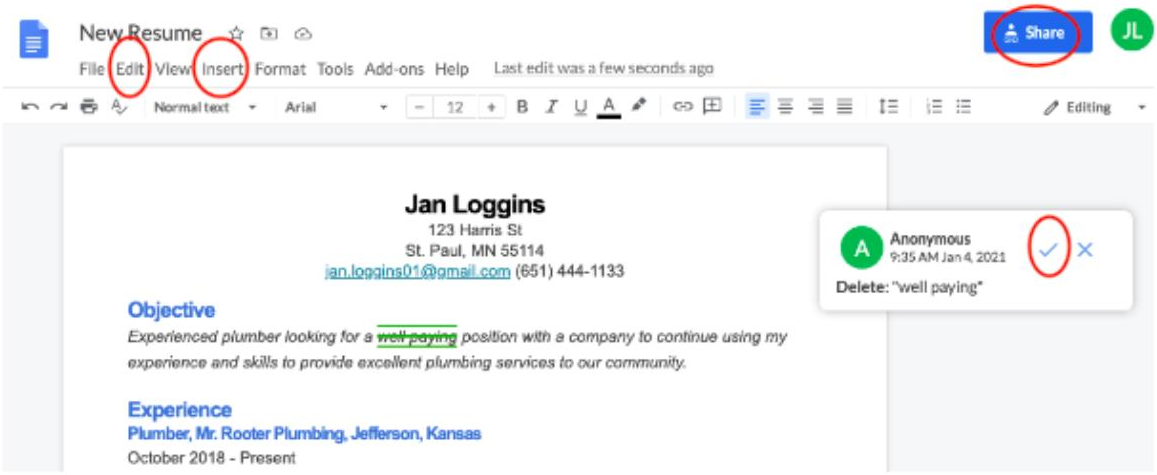
What icon can you click on the screen below to make your computer easier to use if you have bad eyesight? For example, make your mouse pointer bigger. *

- A
- A, B, or D
- B, D, or F
- G
- D, G, or H

Where should you click to easily share this document with multiple people using a link? *

- ◯ Within the address bar to copy the web address
- ◯ On .DOCX
- ◯ On the blue share icon
- ◯ On the comment icon

What edit is being suggested in the document below? *



- ◯ Share with others
- ◯ Fix a spelling error
- ◯ Insert more text under Objectives
- ◯ Remove well paying

(Choose all that apply) Which of these devices will connect you to the internet? *

- [ ] A
- [ ] B
- [ ] C
- [ ] D
- [ ] E

VITA

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