Project-Based Learning and its Effects on 21st Century Learning Outcomes: A Phenomenological Study of Graduates from a New Tech Network Academy

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ABSTRACT

The purpose of this research study was to determine whether a project-based learning (PBL) academy utilizing the New Tech Network (NTN) model positively shaped the acquisition of 21st century learning skills based on the perceptions of graduates from the academy, and to what extent the graduates of this program were able to successfully use those skills after high school. This phenomenological case study focuses on the former students of a New Tech Network (NTN) academy contained within a larger high school in a rural school division in the southeastern United States. Graduates of the program participated in a survey and interview where they were asked to describe their perceptions about the impact that the NTN program had on their development of six 21st century skills. The data collected found that the NTN program had a positive impact on improving the participants skills in self-reliance, collaboration, communication and self-reflection, while also showing that participants felt they were better prepared to be successful in college and career opportunities after high school.
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GENERAL AUDIENCE ABSTRACT

The purpose of this research study was to determine whether a project-based learning (PBL) academy utilizing the New Tech Network (NTN) model positively shaped the development of specific work-based skills using the perceptions of graduates from the academy, and to what extent the graduates of this program were able to successfully use those skills after high school. This study focuses on the former students of an NTN academy contained within a larger high school in a rural school division in the southeastern United States. Graduates of the program participated in a survey and interview where they were asked to describe their perceptions about the impact that the NTN program had on their development of six work based skills. The data collected found that the NTN program had a positive impact on improving the participants skills in self-reliance, collaboration, communication and self-reflection, while also showing that participants felt they were better prepared to be successful in college and career opportunities after high school.
DEDICATION

I dedicate this dissertation to my two children, Brody and Baylee. I have always strived as your father to set an example of setting high goals and working hard to achieve them. I hope you have both seen through my experience that no dream is too big, and that you can accomplish anything you set your mind to. I love you both very much!
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I would also like to thank my parents for everything they have done throughout my life to help me get where I am. You both in your own ways have taught me over the years how to set high goals for myself and work hard to achieve them. Dad, I have watched you work your way up in your career my entire life, and your example and advice has helped me in my own career now. Mom, you have always been my biggest cheerleader and supporter, and you have always had that metaphorical 2x4 ready when I have needed it as well. It goes without saying, but I would not be where I am today without the foundation, love, and support you have given me my entire life.

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CHAPTER 1
INTRODUCTION TO THE STUDY

Purpose of the Study

The purpose of this research study was to determine whether a project-based learning (PBL) academy utilizing the New Tech Network (NTN) model positively shaped the acquisition of 21st century learning skills based on the perceptions of graduates from the academy. This study addressed limited research on the impacts of PBL instruction and the NTN model on students once they have left school. The main objective was to determine, through the perspective of students who have graduated from a NTN academy, whether PBL instruction through the academy had a positive impact on students developing the specific 21st century skills of critical thinking, oral communication, written communication, collaboration, self-reflection, and self-reliance. Additionally, this study determined if NTN graduates feel that they have successfully used these 21st century skills in their lives after high school.

This study was a phenomenological case study of an academy located within a high school in Virginia that implemented the instructional practice of PBL through the NTN model and its impact on building 21st century learning skills in the students that voluntarily went through the program. The study population were students who attended the NTN academy, graduated from the program, and entered post-secondary educational programs or career fields. By researching the perspectives of students who have participated in the program and are now in a post-secondary education setting or workforce, the long-term influence of PBL instruction on developing 21st century learning skills can be determined.

Statement of the Problem

This study looks at the issue of 21st century learning skills and how to best assess an instructional program that is designed to support student growth in these skills. As summarized in Chapter 2, formal assessments of student proficiency in identified 21st century learning skills are not commonplace in public education. Accountability measures and assessments generally focus on measuring core content knowledge, leading to a lack of widespread assessment data on 21st century skills growth. In the last decade, there is a growing push by educational policy makers to align instruction with 21st century skills due to concerns that students are not being
prepared adequately to compete in an increasingly globalized economic landscape. With the increasing focus on 21st century skill development in schools, specific programs that claim to promote 21st century skills have developed in recent years. With the increase of these programs, more research is needed on specific programs that are designed to promote these skills and whether students are growing in their 21st century skill development from them so that school districts can wisely allocate their resources to programs that will provide the greatest benefit for their students. This research study looked at one national program that utilizes PBL instructional methods and focuses on 21st century skill development, the New Tech Network (NTN), and whether its implementation has contributed positively to student’s abilities in 21st century skills.

**Significance of the Study**

Changes in the global economy over the last several decades have led to concerns among policy makers about the preparedness of students to compete in the global marketplace. Of specific concern was the concern that American students were falling behind students in other nations in their content knowledge and abilities to perform at a higher level. On November 9, 2009, former United States Secretary of Education, Arne Duncan, delivered a speech to the U.S. Chamber of Commerce’s Education and Workforce Summit. In this speech, Duncan connected education reform with long-term American economic security. In Duncan’s address, he spoke to the concerns he had about how well the current education system was promoting future economic security of the United States. He claimed the students coming out of American schools were increasingly not meeting eligibility requirements to serve in the military, were not adequately prepared for success in college, and were not receiving the skills necessary for modern work. (Duncan, 2009)

As President Barrack Obama’s Secretary of Education, Duncan was instrumental in the development of the Race to The Top (RTT) grant program that was the center of the Obama administration’s educational policy. As part of the American Recovery and Reinvestment Act, RTT provided $4.35 billion in grant funds to states who were aligned with the educational reforms supported by the Obama administration. One of the criteria for states applying for RTT funds was that they create standards and assessments that prepared students for college and career success and provided them readiness for the workforce. (United States Department of Education, 2009) While only 18 states were awarded grant funds through RTT, a study by
Howell (2015) argued that RTT had an impact on the implementation of Obama administration reform policies in public education systems across the country regardless of whether states were awarded RTT funds or not. Howell compared educational policies enacted by states from 2009, when RTT was first announced, to 2014, and found an overall increase in RTT supported educational policies in all states regardless of whether they were awarded RTT funds, applied for funds, or did not participate in RTT. His concluded that RTT could be partially responsible for the wave of educational policy reform that took place across the country even though only a small percentage of states participated in the RTT program.

Virginia submitted for a RTT grant in the first round of awards but was not awarded funds. According to the United States Department of Education, it was Virginia’s unwillingness to adopt Common Core national standards that contributed to their denial in the original RTT grant. Virginia Governor Robert McDonnell decided in the spring of 2010 when a second round of RTT grants were available not to submit a second application. Both Governor McDonnell and Virginia’s Superintendent of Public Instruction Patricia Wright stated that they were unwilling to adopt the Common Core standards required in RTT because they felt Virginia’s current standards were more rigorous. Superintendent Wright stated that Virginia was committed to reforming their schools, but would do so without RTT (Roth, 2010).

The Standards of Learning (SOL) Innovation Committee, whose work began in 2015, took on the task of reforming assessments used in public schools in Virginia. In 2017, the SOL Innovation Committee created the High School Redesign Subcommittee, whose purpose was to develop policy recommendations to the Virginia Board of Education. The subcommittee centered their work on the “5Cs”: critical thinking, collaboration, communication, creativity, and citizenship. With their recommendations, they sought to align the policy proposals they were making with these five concepts. In their recommendations, they recommended that Virginia high school students have more experiential learning opportunities, with students participating in more authentic experiences that models the world of 21st century work. They also recommended high schools offer more courses that “blend” two or more subjects together into one single course. They also pushed for a more balanced assessment system in Virginia high schools, moving away from traditional assessments and towards more performance-based instruments. In the introduction of their policy recommendations, they state that the purpose of creating a high school redesign subcommittee was to “ensure all Virginia students have an experience in grades
nine through twelve that prepares them to succeed in a rapidly changing economy.” (SOL Innovation, 2017)

Almost simultaneously with the work being done on the SOL Innovation Committee, the General Assembly passed legislation that directed the Board of Education to redefine graduation requirements for Virginia high school students. In the legislation, the Board was directed to develop what was called a “Profile of a Virginia Graduate”. The purpose of this profile was to list the skills and attributes a typical high school graduate would need to be a successful citizen upon graduation. The legislation required a diverse group of educational stakeholders to participate in the creation of this Profile, including representatives from businesses in the state. In *The Profile of a Virginia Graduate*, the 5Cs heavily influenced the goals established by the Board of Education and identified the following goals:

- Accumulate appropriate content knowledge
- Develop workplace skills
- Become aware of and engaged in their community
- Be able to apply knowledge to potential career paths

The Profile became a part of the Board of Education’s revision of the Standards of Accreditation in 2017 and led to revised graduation requirements for Virginia High School students starting with the 2018-2019 9th grade cohort (Virginia Board of Education, 2017).

Individual school districts have started to look at their own schools and instructional practices, and how they can better align with the goal of preparing students with the knowledge and skills they need to compete in the globalized economy. One program that has been implemented in public schools across the United States has been the NTN. The NTN is a whole-school reform model that utilizes the instructional practice of PBL to deliver instruction to students, but also emphasizes areas like school culture to make schools more effective and engaging for students. According to the NTN, their program was founded to meet the unique needs of technology companies in California in the 1990s. The NTN has expanded their program beyond Silicon Valley to build 21st century learning skills so that they can better compete in a globalized economy. As of September, 2021, 206 schools across the United States have affiliated themselves with the NTN and are using their model (New Tech Network, n.d.).
The NTN Model

According to the NTN (2020), the instructional model implemented in schools around the United States centers around four primary characteristics: learning outcomes, PBL instruction, school culture, and integration of technology. All schools who join with the NTN are expected to implement all four of these characteristics in their schools in order to be designated as an NTN school. A further discussion of each of these four primary characteristics are found below.

Learning Outcomes

The NTN established five learning outcomes that drives the instruction and assessment that takes place in their affiliated schools. The stated goal of these learning outcomes is to help prepare students for success in college and career pursuits. Each learning outcome is assessed in NTN schools and factors into their academic grade. The first learning outcome is academic knowledge and thinking concepts, which are unique for each discipline and promotes deeper thinking skills students need to be prepared for college. The second learning outcome is collaboration, which assesses student’s ability to work in teams to accomplish a task. The learning outcome of written communication is embedded in all academic areas and is used to help students build their ability to communicate effectively and build deeper thinking skills. Oral communication is assessed to help cultivate a student’s ability to speak publicly and defend their ideas. The final learning outcome of agency is used to build a student’s capacity to take ownership over their learning and be a life-long learner (New Tech Network, 2020).

PBL Instruction

All NTN affiliated schools use PBL instruction as the primary means of delivering academic content to students. The NTN learning outcomes are embedded into each PBL unit teachers design and is assessed through authentic performance assessments. Each NTN school is required to integrate at least two academic areas together into one co-taught class in every grade-level that is taught collaboratively by the two teachers. Teachers are encouraged to build PBL units that connect to the student’s larger community and partner with community resources so that academic concepts are applied in authentic contexts (New Tech Network, 2020).

School Culture

NTN summarizes their school culture philosophy into three words: trust, respect, and responsibility. The NTN model emphasizes these three characteristics in building the culture
between students and teachers in the classroom. Teachers are encouraged to provide more freedom to students within the confines of the school environment, and students are taught how to handle the greater freedom responsibly. NTN also applies positive culture building among the staff as well, encouraging a spirit of collaboration and shared decision making among the adults in the building (New Tech Network, 2020).

Technology Integration

Schools that agree to be affiliated with the NTN model must invest in a 1:1 student-to-computer ratio. Students use computers to create products, research information, and access their learning. The NTN also develops their own Learning Management Software (LMS), Echo, that member schools use with their students. Through this LMS, teachers organize all aspects of the PBL process for students by uploading materials, assignments, and posting grades and feedback. The Echo LMS is also used by NTN to network teachers across all the affiliated schools by allowing teachers to post and share projects through the software (New Tech Network, 2020).

Research Questions

This study of graduates of a New Tech Network program was guided by the following research questions:

1. What was the perceived impact of the New Tech Network model of Project-Based Learning on the development of 21st century learning skills while in high school?
2. What was their perception of how they have utilized the 21st century skills taught in the New Tech Network model in their lives since leaving high school?

Research Assumptions

Creswell and Poth (2018) stated that all researchers carry their own personal values into a research study, and that these values should be identified. The researcher prior to this study spent four years as both a teacher and an administrator in an NTN affiliated program after spending eight years teaching in a traditional non-NTN high school setting. The short amount of time spent teaching in an PBL environment made the researcher an advocate for PBL instruction over more traditional means of instruction. From the perspective of the researcher in the classroom at the time, informal comparisons were made between the outcomes of those who were taught through traditional means and those who were taught through PBL. It was believed that students
who were taught through PBL developed a deeper understanding of the content being taught. However, it was other skills that students were exhibiting through PBL instruction that made the researcher feel that PBL instruction was superior to traditional means. It appeared that students taught through PBL were better writers, communicators, collaborators, and took more initiative than students who were not taught using the method.

The bias towards PBL teaching methods over traditional teaching methods must be recognized prior to embarking on this study. The genesis of this bias comes from informal observations made by the researcher while in the classroom, with imperfect comparisons to previous groups of students that were taught in previous academic years. Recognizing that this bias towards PBL instruction lacks academic rigor, the results of this study will provide data that will either affirm or disprove what has previously been thought as true. To mitigate these researcher biases, the study researches the perspective of the former students of an NTN academy, with their voices driving the conclusions drawn about the long-term efficacy of PBL instruction on students. Questions asked of the research subjects were carefully monitored and edited for bias towards PBL and were crafted to be open ended so that the research subjects would provide their own perspective towards each question as opposed to the researcher’s.

**Limitations and Delimitations**

The primary limitation of this study is the population group of former students involved with the NTN academy. Previous research studies that seek to look at impacts on student achievement use sample populations of students who are currently in school. Unless for a specific purpose, research studies do not include former students as a population group. While this study is limiting its scope to former students of an NTN program, the ability to recruit participants was a challenge and was a limitation to this study.

The primary delimitation of this study is the setting of the study. This study is purposely limited to the NTN program, and while the data generated from this study could be applied to other PBL settings, the NTN program is a school-wide reform approach that expands beyond PBL instruction. By limiting the scope of this study on just one NTN program and its graduates, the program can be assessed as to how they are providing growth in 21st century learning skills.
Organization of the Study

In Chapter 2, a review of salient academic literature on 21st century learning skills, project-based learning, and the NTN will lay the groundwork for previous research on these topics. Chapter 3 will provide a description of the methodology and design for this case study of the NTN school and its graduates. Chapter 4 will provide the data collected through the participant surveys and interviews, and Chapter 5 will provide the findings, conclusions, and summary of this study.

Summary

Entering the third decade of the 21st century, public school policy in the United States has started to shift away from instruction and assessment that is focused solely on content knowledge acquisition, and towards “real-world” skills collectively known as 21st century learning skills. With the policy emphasis on the 5Cs and the Profile of a Graduate in Virginia, instruction in the classroom has started to shift to align with these policy initiatives. National organizations like the NTN have developed in conjunction with public schools to help provide a whole-school model that is centered on 21st century learning, with PBL as the curricular centerpiece of their model. This qualitative case study seeks to determine what effect the NTN program and PBL instruction have on student’s acquisition of 21st century learning skills by highlighting on one specific program in Virginia.
CHAPTER 2
REVIEW OF LITERATURE

Overview of the Study

The purpose of this research study was to determine whether a project-based learning (PBL) academy utilizing the New Tech Network (NTN) model positively shaped the acquisition of 21st century learning skills based on the perceptions of graduates from the academy. This study addressed limited research on the impacts of PBL instruction and the NTN model on students once they have left school. The main objective was to determine, through the perspective of students who have graduated from a NTN academy, whether PBL instruction through the academy had a positive impact on students developing the specific 21st century skills of critical thinking, oral communication, written communication, collaboration, self-reflection, and self-reliance. Additionally, this study determined if NTN graduates feel that they have successfully used these 21st century skills in their lives after high school.

Key Terms

When reviewing the literature, the terms 21st century learning skills and project-based learning both found a degree of variance in terms of their definition. In the research literature, the terms 21st century learning and 21st century skills are used interchangeably and are sometimes combined as 21st century learning skills. For consistency, 21st century learning skills will be the terminology used in this review of the literature. While the literature will show variance in terms of what specifically is defined as essential 21st century learning skills, broadly 21st century learning skills are defined as specific attributes students need to be able to be prepared for the economic realities of the globalized economy they will compete in after their formal education is complete.

The term project-based learning also shows variance in the research literature. Some of the difference in the literature comes from the acronym PBL. In the research literature, the acronym PBL is used interchangeably to describe not only project-based learning, but also problem-based learning as well. Adding to the confusion, some literature sources identify project-based learning through the acronym of PjBL and reserve PBL for problem-based learning. Other sources identify problem-based learning as PrBL, and reserve PBL for project-
based learning. For this review, the acronym PBL is used to represent project-based learning because it is the most commonly used acronym found in the research literature. The terms *project-based learning* and *problem-based learning* are not used interchangeably because while related, the two systems are separate pedagogical processes. Based on Allen et al.’s (2011) description of problem-based learning, there are a lot of similarities between problem and project-based learning approaches, which explains why some research literature treats them interchangeably. In problem based-learning, students are focused on solving a particular real-world problem that is posed to them using the curricular knowledge they have gained throughout a teaching unit. Students are expected to be self-directed in their learning, with instructors acting more in the role of a facilitator. Also, problem-based learning promotes the development of what Allen et al. call “soft-skills”: research, teamwork, and communication.

Savery (2006) noted the main distinction between these two learning processes is the final student product that is created by students as part of the learning process in project-based learning. While both project-based learning and problem-based learning uses real-world problems, the project-based process approach requires students to develop an actual product as part of their approach to the real-world issue, while problem-based learning focuses more on students resolving issues in theory. This review of literature summarizes the research on project-based learning over problem-based learning due to the research interest in the NTN. According to the NTN (2020), all schools that are affiliated with their network use project-based learning as the main pedagogical approach to teach the curriculum in their schools.

The research literature on PBL showed some variance in the characteristics of the practice. For this review, PBL is broadly defined as a form of curriculum design where students are given a project or product to create that addresses a driving question that is designed to have students apply content knowledge in a real-life situation or problem (Barron et al., 1998; Blumenfeld et al., 1991; Moylan, 2008; Thomas, 2000).

Assessment of 21st century learning skills has been identified as a weakness for education systems, with so much of the current focus of assessment on student attainment of core content knowledge (Silva, 2009; Tienken, 2020; Wagner, 2008). The review of literature on assessment of 21st century learning skills will highlight where the deficiencies currently lie in assessing 21st century skills, and recommendations for assessing 21st century learning skills. The literature will
show a connection between projects and assessment of 21\textsuperscript{st} century skill development in students.

PBL is a complex instructional practice that involves extensive training in order for teachers to execute effectively. For this reason, several organizations have been developed to help support schools in their efforts to implement PBL into their curriculum and instruction. In recent years, research has started to study these specific organizations and their models of PBL instruction as opposed to just researching PBL in broad terms. This review highlights one model of PBL instruction, the NTN model, and what research has shown so far as to its impact on student outcomes.

\textbf{Literature Search and Review Process}

The majority of the primary sources used in this review were found initially through searches from the EBSCOhost databases from July, 2020 through November, 2020. As the research process expanded, other resources were found using the Google Scholar database to search for specific sources that could not be located on the EBSCOhost research databases.

The research process began by accessing the ProQuest Dissertations and Theses Global database. The key terms of “21\textsuperscript{st} Century Skills” and “Project-based Learning” were used and received 197,604 results. To narrow down these results, dissertations that were published more than ten years ago were excluded, as well as those dissertations that did not address both 21\textsuperscript{st} century skills and project-based learning. Eventually, findings were narrowed down to five dissertations.

The EBSCOhost database was used to search for additional research in 21\textsuperscript{st} century learning skills and PBL. The key search term “21\textsuperscript{st} century skills” returned 1,676 different sources. To narrow these results, the following inclusion criteria was used: peer-reviewed academic journals, only studies from American schools, and studies published between 2000 to 2020. These search criteria narrowed the number of sources down to 51.

After researching sources that pertained to “21\textsuperscript{st} century skills”, the key search terms of “assessment” to “21\textsuperscript{st} century skills” were used, which returned 158 different sources. Many of the sources included in the search returns focused on non-academic settings, so these were excluded and only research literature that pertained to assessment of 21\textsuperscript{st} century learning skills within the academic setting were reviewed. Due to the limited number of sources of K-12\textsuperscript{th}
studies in assessment and 21st century skills, the inclusion criteria was expanded to research studies in post-secondary settings as well.

After researching sources regarding 21st century skills, the key search term of “project-based learning” was used and returned 2,814 entries. The number of entries was narrowed down by adding the key term of “description”, returning 69 different sources. The key term of “student achievement” was added with “project-based learning”, returning 115 sources. By including only sources that pertained to middle school or high school studies of PBL on student outcomes, this narrowed the total number of sources reviewed.

The final search of research literature sources narrowed in on the NTN model. In the EBSCOhost database, the key search term of “New Tech Network” returned 22 different sources. The search returned some periodical resources, which were excluded, and peer-reviewed research studies that were included in this review of the literature.

Definition of 21st Century Learning Skills

Reviewing the research literature on 21st century learning skills, there is a degree of variance in how different researchers and organizations define what 21st century learning skills are. Rios et al. (2020) theorized this is due to different methodologies being used to define 21st century learning. They identify three methodological frameworks for identifying 21st century skills: theory-driven, job analysis, and employer survey. These differences of identifying what 21st century learning skills have translated to confusion among education practitioners as to what 21st century skills are. Beck (2020) asked teachers to define 21st century skills and found that teachers responses varied from one another, and there was no common definition as to what each skill looked like in practice. While there may be disagreement about what specific skills belong under the category of 21st century learning skills and how they would be defined, there is a general consensus in the literature that 21st century learning skills are defined by skills students can use to apply core content knowledge to specific challenges that will help prepare them for the realities of the global world they are growing up in (Chalkiadaki, 2018; Rotherham & Willingham, 2010; Sahin, 2009; Silva, 2009; Wagner, 2008).

Despite the name, the literature on 21st century learning skills stated that this is not an inherently new idea. Humans have needed the skills that are defined as “21st century” since the beginning of human civilization. While the skills are not new, the importance of having the skills
has grown in the current century. Due to the economic and technological changes of the new century, students now more than ever need the higher thinking skills that are defined as 21st century learning skills (Rotherham & Willingham, 2010; Silva, 2009).

In the research literature on 21st century learning skills, the education policy organization Partnership for 21st Century Learning (P21) is cited in terms of defining 21st century learning skills (Chalkiadaki, 2018). According to P21’s Framework for 21st Century Learning (2016), they identify four broad categories of 21st century learning skills: key subjects and 21st century themes, learning and innovation skills (4Cs), life and career skills, and information/media/technology skills. Within the category of key subjects and 21st century themes, they state that core content knowledge should be mixed with larger interdisciplinary themes to promote higher level thinking. Under learning and innovation skills, students should learn the 4Cs of creativity and innovation, critical thinking and problem solving, communication, and collaboration. P21 also emphasizes technology and media literacy as an essential 21st century skill due to the importance these mediums have in modern life. Finally, under life and career skills they promote the specific skills that will help students adjust to the demands of a modern work atmosphere.

Using interviews with both business leaders and educators across the country, Wagner (2008) identified seven “survival skills” students need to compete globally in the 21st century. The seven skills were: critical thinking and problem solving, collaboration, agility and adaptability, initiative, and entrepreneurialism, effective written and spoken communication, analyzing information, and curiosity and imagination. By obtaining these seven skills, Wagner argued that students would not just be more prepared to compete in the modern economy, but would also improve their ability to be an engaged citizen and lifelong learner.

Due to the wide range of literature seeking to define 21st century learning skills, Chalkiadaki (2018) set out to synthesize the research literature around 21st century learning skills. The research focus of his synthesis was to identify and categorize the skills that most commonly appear in research on 21st century learning. Based on his findings, Chalkiadaki organized the common skills found in the literature into four broad categories: personal skills, social skills, knowledge and information skills, and digital literacy skills. Personal skills were identified as containing essential skills like creativity, problem solving and critical thinking, and self-development. Social skills involved communication, collaboration, and increasing student’s
sense of global awareness. In knowledge and information skills, research literature showed a large amount of attention on student self-reflection and learning how to learn. In digital literacy, the research showed a strong emphasis on students needing to know how to use digital tools.

Rios et al. (2020) took a different approach at identifying what are essential 21st century learning skills. In their study, they looked at approximately 142,000 online job advertisements to see how the job requirements posted in the advertisements compared to the most commonly referenced 21st century skills in the research literature. They found the 21st century skills most frequently found in job advertisements were oral communication, written communication, collaboration, and problem solving. They also found that the demand for certain 21st century skills increased as minimum education level increased. The demand for collaboration skills increased as the minimum level of education of a job increased. They also found that some 21st century skills that are frequently cited in the research literature were not in as high demand by employers. While skills like creativity and cultural sensitivity appear frequently as essential 21st century skills in the research literature, the researchers only found the demand for creativity in approximately 4% of job postings and cultural sensitivity was found in approximately 1% of job postings.

Assessment of 21st Century Learning Skills

In the literature on 21st century learning, assessment of 21st century learning outcomes was a frequent challenge. In 2001, the Federal government passed the No Child Left Behind Act, which had a major impact in shifting the curricular focus of schools during the early part of the 21st century. Under the law, schools were mandated to show improvement in the learning outcomes of their students in English/Language Arts and Math. The primary mechanism through which schools showed the proficiency level of their students was through standardized assessment systems created by each state (Klein, 2015). Wagner (2008) argues that these antiquated curriculum and assessment systems were created based on political and financial considerations that are not preparing students for the 21st century realities students are facing. Due to the extreme penalties that came from not meeting the mandates of NCLB, individual schools aligned their curriculum with the assessments. This led to teaching that was emphasized covering a breadth of content, as opposed to larger skills (Tienken, 2020).
Research has shown there is a disconnect between the education students are receiving, and the preparation for the realities of the 21st century, particularly in historically marginalized communities. Diamond (2012) studied the teaching practices of 105 classrooms in Chicago and found that the instruction students received was overwhelmingly teacher centered. In the classrooms studied, teachers dominated the questioning in 93% of classrooms, students did not interact with one another in 73% of the rooms, and students were only asked to think deeper about concepts in 11% of classrooms. The researchers also found that this teacher dominated approach of instruction was predominately found in schools where the majority of the student population was Black. Teacher driven instructional practices in marginalized communities have only increased with the high stakes testing that has come from the accountability mandates in the No Child Left Behind legislation. Due to the pressure of meeting Adequate Yearly Progress, schools in danger of not meeting benchmarks relied on instructional practices that promoted rote memorization rather than more innovative and research-based practices (Diem & Welton, 2020).

With the passage of the Every Student Succeeds Act (ESSA), the reliance of student achievement test results as a means of school accountability has shifted from the federal government to the individual states. Due to the recency of the law, the research on the impact of ESSA on instructional practices of teachers is minimal. Schuler et al. (2017) studied one underperforming school system in Massachusetts that went through state takeover under ESSA. Demographically, the school system had high levels of economically disadvantaged students, as well as a high number of Hispanic students. The school turnaround plan implemented by the state targeted teacher quality, with efforts made to improve the practices and expectations teachers had for their students. After two years, they found the turnaround efforts led to increased student performance in math and language arts.

The research literature (Silva, 2009; Wagner, 2008) argued for a curriculum and assessment system that moves beyond the emphasis of rote content memorization and focuses on more of the 21st century thinking skills that are aligned with preparing students for higher learning opportunities and the careers of the future. Literature highlighted the Collegiate Learning Assessment (CLA) and the College and Work Readiness Assessment (CWRA) as tests that were being used to better assess student’s attainment of 21st century skills. Rather than measuring attainment of core content knowledge, the CLA and CWRA are designed to measure a student’s problem solving and writing skills through a performance assessment (Silva, 2009;
Wagner, 2008). Darling-Hammond (2009) further argued the case for assessments that are more performance-based and that engage students in authentic/real-world problem solving and moving away from standards and assessments that require students to simply memorize facts. Furthermore, Darling-Hammond advocates for assessment development to become more decentralized and placed back in the hands of individual teachers as opposed to being created at the state level.

Silva (2009) stated that a primary argument against teaching and assessing 21st century skills would be it is done at the expense of teaching core content. Instead of teaching and assessing core content and 21st century learning skills separately, Silva argued that they should be taught together in the classroom. Assessments should then be redesigned to reflect student attainment of both core content knowledge and 21st century skills. Bell (2010) further argued that current assessment systems do not adequately measure 21st century skills, and that assessment systems should be reconsidered to more accurately measure 21st century skills development.

Rather than trying to measure every 21st century skill collectively as one, research has broken apart 21st century skills and how they can be assessed individually. Care et al. (2016) developed an online assessment of collaborative problem solving by having two students work together to complete a problem-solving task. Through the student actions taken in the task, inferences could be made about the level of collaborative skills being exercised by the students. Lucas (2016) focused on the assessment of the 21st century skill of creativity. Lucas argued that trying to assess students on creativity through summative methods would be difficult to determine accurately, so the assessment of creativity should be for formative means. In the study, an assessment tool for creativity was developed and used, and it was found that the tool helped teachers and students understand creativity more and build their capacity in the skill. Shavelson et al. (2019) studied the effectiveness of assessing critical thinking ability through the use of a performance task assessment. German university students were asked to perform a real-world task related to wind turbines, and after the completion of their task were surveyed on their cognitive processes during the task. They found through the interviews that students who utilized more critical thinking skills had higher scores on the task than those who did not.
Instruction and Assessment of 21st Century Skills

Nehring and Szcesiul’s (2015) case study of secondary schools in Northern Ireland showed that moving beyond traditional assessment methods of content focused exams would lead to more evidence of 21st century skills development. In the classrooms they observed, they found that 21st century instruction and skills development was more evident when the teachers used fewer traditional exams. They further found classrooms that assessed student learning through projects had more 21st century skills instruction than those that assessed primarily through traditional exams.

Several research studies supported this link between 21st century skills development and projects (Bell, 2010; Mosier et al., 2016; Moylan, 2008). By engaging in projects, students frequently use 21st century skills like critical thinking, collaboration, communication, self-reflection, and self-reliance. Through projects, students found more personal relevance between their schoolwork and future careers they may pursue. In one study of high school students in a PBL driven high school, student interviews of their perceptions of PBL found that the roles students took in several of the projects they completed inspired them to explore certain careers after high school (Moiser et al., 2016). The open nature of projects also allowed for students to personalize their learning and be able to tap into their own interests (Moylan, 2008). Research also showed that students were able to improve the 21st century skill of global citizenship by building their understanding of other cultures and creating a greater sense of global cooperation. This skill improves due to students frequently addressing real-world issues through projects, leading to students developing a greater understanding and awareness of the world around them (Moylan, 2008).

History of PBL

Just as the literature on 21st century learning skills indicated that these skills are not new ideas to education, the literature also showed that project-based learning is not a recent instructional practice in education. Barron et al. (1998) stated that projects were first commonly used in American schools at the turn of the 20th century, with projects commonly involving students in work in which they would personally be engaged in. Projects were also present in early 20th century science instruction, with the use of “home projects” in a Massachusetts agricultural school. In these projects, students would use the content taught at school, and apply
them in their farms at home (Colley, 2008). As the century went on, the prevalence of PBL instruction declined for several reasons: lack of resources and time to create new curriculum, an increase in class size, and lack of teacher independence to create innovative curriculum (Barron et al., 1998).

**Characteristics of PBL**

Blumenfeld et al. (1991) characterized the two defining features of the instructional practice of project-based learning (PBL): a driving question and a final product that students create. The driving question of a project centers the students around addressing a specific problem. The driving questions and problems students address generally replicate a real-world issue in order to make the learning experience for students more authentic. This authenticity helps sustain student engagement in the process. Through the development of a product or artifact students demonstrate their answer to the driving question. Effective projects are designed with strong driving questions and activities throughout the course of the project to support student development of the final product or artifact. Blumenfeld states that these driving questions and products also should not have a predetermined outcome, but instead are driven by the student’s approach to answering the problem and question.

Barron et al. (1998) identified four principles of PBL design through their work at Vanderbilt University:

- Learning goals that connect the product that students are developing with a deeper understanding of content knowledge.
- Scaffolds that are built in to help students in the process of research and developing their product.
- Multiple opportunities for students to reflect on their work and revise what they are doing throughout the project process.
- Systems developed that promote student ownership and agency over their own learning.

These four principles work together to develop a process where students learn the desired content and skills, as well as develop more responsibility and ownership over their learning.

Colley’s (2008) definition of project-based science instruction delved deeper into the role of teachers and students. In a project-based environment, teachers take on the role of facilitator
of learning, while students take more of an active role in the learning process. There are even times where the roles of student and teacher reverse, as each group seeks to learn from one another in the process. Direct instruction by the teacher is limited in a PBL environment and is replaced by student research and experimentation.

Bell (2010) further defined PBL as more than a support activity in a traditional teaching unit. Rather, PBL should be considered more as a curricular approach that supports the entire learning process for students. Research has characterized PBL as a complex process requiring large amounts of teacher preparation to execute. Prior to the start of an effective project, teachers have to define what is be studied, determine how much time a project should take, predict the potential challenges students will encounter, and select the proper ways to assess the learning outcomes of the project. Researchers have indicated that this complexity is why PBL is not as widely practiced in schools (Barron et al., 1998; Blumenfeld et al., 1991; Carr, 2017; Colley, 2008).

As the literature on PBL shows, there is no one defined set of characteristics of what constitutes a PBL teaching unit in a classroom. Thomas (2000) addresses this complexity and variance in the research literature in his review of PBL research. To clarify what the research identifies as PBL instruction, he offers five characteristics of PBL instruction:

- PBL is not an addition to the curriculum that is taught in the classroom, but is the central part of the curriculum. The project students work on is the primary driver of what is and is not taught by the teacher.

- PBL projects are “driven” by a problem or question that ties together the content knowledge, major themes, and performance products the students are creating through the course of the project.

- PBL projects must have students participate in a learning process that has students investigate, discover knowledge, and build meaning themselves. If the main task a student is working on requires no difficulty or can be completed with already known knowledge or skills, then it is not considered PBL.

- The students, their interests, and their creative approach to a problem are the main drivers of the direction of a PBL project. Teachers play a minimal role in directing the course a PBL project takes.
PBL projects mimic real-world problems and situations and try to get students to take on the roles of real-life actors as much as possible.

Effectiveness of PBL

The research literature on the PBL has frequently found the practice has a positive effect on student engagement in schools (Blumenfeld et al., 1991; Carrabba & Farmer, 2018; Grant, 2011; Mosier et al., 2016; Virtue & Hinnant-Crawford, 2019). A quantitative study surveying student perception of PBL found a positive relationship between student engagement and learning in a PBL environment (Mosier et al., 2016). In another study comparing middle school students who received science instruction through PBL to those who were taught using direct instructional methods found significant differences in the motivation and engagement of students who participated in PBL over direct instruction. Students who were taught using PBL methods reported more motivation and engagement over those who were taught primarily using direct instructional methods (Carrabba & Farmer, 2018). In Grant’s (2011) qualitative case study of middle school geography students who were taught using PBL, the students reported that projects were fun and engaging because they liked the freedom to approach their project in their own way.

Research literature has also addressed the effect of PBL instruction on student achievement, showing positive effects in this area. Chen and Yang (2017) performed a quantitative meta-analysis of published studies comparing the effect of PBL and traditional instructional methods on student achievement from 1998 to 2017. In 29 out of the 30 studies PBL had a positive effect size, with an overall mean effect size of 0.71 which indicated a large overall effect of PBL instruction on student achievement. They also found that the overall effect size of PBL increased over the studies done in the last decade compared to earlier studies, which they attributed to the increase in the practice of PBL in more classrooms. PBL showed a greater effect in elementary school settings compared to middle and high schools. Although PBL showed a positive effect on student achievement, the effect was not uniform across all academic subjects. PBL instruction showed the greatest effect on social studies achievement and showed the least amount of effect on mathematics achievement.

A longitudinal study by Summers and Dickinson (2012) found that student who received instruction in a high school that taught predominately through PBL had higher rates of grade
level promotion than a high school that taught primarily through traditional methods. The largest gains in grade level promotion were found among Black, Hispanic and economically disadvantaged students. When comparing student performance on state mandated social studies assessments, even though there were high passing rates in both instructional settings they found that the students who attended the PBL high school consistently passed the assessment at higher rates throughout the study period, with overall pass rates in each year of the study between 96% and 99%.

Tienken (2020) identified PBL as a “promising practice” when compared to other types of common educational reforms that are used in modern public educational settings. The philosophy of PBL is not new; he stated that the idea of making connections between core content and authentic problems through active exploration was advocated for by John Dewey at the beginning of the 20th century. More than just a poster board, true PBL allows a student to engage in inquiry to solve a particular problem or challenge. PBL units often stretch across multiple disciplines, which more closely resembles real life, and allows students to work collaboratively to complete the project. True PBL units provided limited teacher-mandated parameters for the student work, so students are able to approach a problem using their own unique voices and choices.

Christopher Tienken (2020) identified five lenses of critique when evaluating an educational reform initiative:

- Does the reform conform with the historical goals of public education?
- Does the reform align with the science behind how students learn?
- Does the reform allow the learner to be an active participant in their learning?
- Does the reform allow the student to connect their learning to other knowledge and skills?
- Does the reform respect and promote the dignity of all students?

Tienken used these five lenses to evaluate the instructional practice of PBL and found that the practice promoted all five of his criteria. It conformed with the three historical goals of education because it not only focuses on developing the content mastery and skills of students, but also promotes the civic growth of students through the introduction of projects that have students build their awareness of social issues. By allowing student voice and choice, PBL fits into Tienken’s lens of human development and active learning, since students are encouraged to
approach projects in their own unique and creative ways. Tienken’s lens of knowledge acquisition is also met with PBL, because students are encouraged to be active participants in their learning. In PBL units student are encouraged to connect their learning to prior experience. Finally, PBL fits within Tienken’s critical lens of ethics because the instructional practice is well suited to have students explore issues related to social justice, equality, and human rights. By having students explore issues of social justice, it increases the likelihood that they will become more civically engaged in their communities both as a student and later on in adult life than those who are not exposed to social justice issues in their curriculum.

**NTN Schools and Student Impacts**

A growing number of schools across the country are practicing PBL instruction utilizing the New Tech Network (NTN) model. According to the NTN (New Tech Network, 2016) about 200 schools across the United States and Australia have adopted the NTN model. The NTN was developed to address the 21st century learning goals of preparing students to meet the demands of the modern workplace. Instructionally, the NTN uses the PBL model identified by Blumenthal et al. (1991); however, what distinguishes NTN from other PBL programs is that PBL is just one piece in their whole-school approach to addressing 21st century learning and skills. The NTN places an emphasis on building a whole-school collaborative culture that is driven by what is termed as “TRR”: trust, respect, and responsibility. The NTN model promotes the inclusion of student technology in the PBL process to help students in their growth towards the 21st century skills of creativity, communication, digital literacy, and self-directed learning. To measure student growth in the NTN model, they assess students in collaboration, written and oral communication, core content knowledge and thinking, and student ownership of learning with defined learning outcomes and criteria provided by NTN.

Research by Ravitz (2010) looked at the school reform models like NTN to determine how effective they were at changing student and teacher culture and implementing PBL instruction. Based on a quantitative analysis of survey results of teachers across the country, school reform models like NTN had a greater impact on improving teacher and student culture, with reform model school reporting a higher z score for each question asked than smaller schools and larger comprehensive schools. It was also found that PBL implementation was carried out
more frequently in reform model programs compared to smaller high schools and larger comprehensive schools.

Culclasure et al. (2019) studied three NTN schools (elementary, middle, and high) in the Southeastern United States to look at the impact the NTN model had on social-emotional and behavioral outcomes of students. They found that NTN students at the elementary and middle school level scored higher in social-emotional behaviors than their peers at similar age level. NTN students showed a particular strength in social awareness and relationship skills comparable to students in their average peer groups. Comparisons were also made in the school behavioral and discipline outcomes between students who attended the three NTN schools and those who do not attend an NTN school. They found that there was a statistically significant difference in out of school suspensions between NTN and non-NTN students, with NTN students averaging .170 suspensions per year compared to non-NTN students who averaged .267. There was also a statistically significant difference in discipline incident reports between NTN and non-NTN students, with NTN students averaging .996 reports per year compared to 1.224 of non-NTN students. While the differences in behavioral outcomes showed statistical significance, it was only a small difference leading the researchers to conclude that the impact of the NTN model did not have a large effect on student behavioral outcomes. However, they did conclude the largest impacts of the NTN model came in the development of student’s social-emotional skills.

A study by Hernández et al. (2019) looked at how three deeper learning network systems that included NTN were able to successfully recreate their model of schools across the country. They found that the NTN model created an overall school system that was centered around the goal of deeper student learning that schools who wished to join their system had to agree to. However, they found that these conditions were not mandated unilaterally, but were instituted collaboratively with the local stakeholders who were seeking to apply their learning model in their school. They also found that NTN supported teacher growth through a system of professional development that was ongoing and helped teachers build their capacity to implement PBL practices. This support is also given to leadership within NTN schools as well, so they could be knowledgeable in the practices of PBL in their schools. Finally, they found that the NTN model was successful due to the continuous drive to improve their practice and share those improvements with schools in the network.
Craig and Marshall (2019) compared standardized assessment data in mathematics and science between students who attended an NTN model high school and those who attended a traditional school in the same district in Texas. Using linear regression analysis, the researchers found that there was no significant difference in the mathematics performance of NTN students compared to regular students on the state assessments, however they did find a significant difference in the performance of students on the 10th grade science assessment with students who were in the NTN school showing greater mastery in the state science assessments. These findings support previous research on PBL showing a lesser effect on student achievement in mathematics compared to other core subject areas (Chen & Yang, 2017).

Virtue and Hinnant-Crawford’s (2019) qualitative research on NTN high schools focused on the student perspective in this PBL model. Students who were interviewed in this study supported the quantitative analysis found in Craig and Marshall (2019) by indicating that certain subjects worked better in PBL than others. They indicated that English/Language Arts and Social Studies worked well in their NTN classes, while indicating that mathematics did not lend itself to PBL. Overall, students reported a high degree of satisfaction with PBL through the NTN model. The researchers pointed out that student responses showed a sense of pride in their work because they could see how it fit within real-world problems and had meaning. They also spoke of how their experiences in the NTN model helped them build their resiliency to overcome challenges.

Mosier et al.’s (2016) quantitative study of student perceptions of the NTN model and PBL and how successfully they felt it was implemented in their school. Based on the survey responses of the students, the researchers found a positive linear correlation between PBL and engagement in school. They also found in open ended responses from the students a connection between the work they were completing in class, and future careers.

Summary

The literature on 21st century learning skills emphasized the necessity these skills have in preparing students for the economic realities of the globalized world they are inheriting (While the research literature shows discrepancies between which specific 21st century learning skills should be emphasized, the skills of communication, collaboration, and critical thinking or problem solving consistently showed up in the research on 21st century learning skills (Chalkiadaki, 2018). Because of the importance of 21st century learning, researchers have argued
for more emphasis to be placed on instructing students in these skills and assessing students for their attainment (Silva, 2009; Wagner, 2008).

Research on PBL has concluded that this curricular approach not only helps students learn important 21st century skills, but also can be used to assess student progress towards developing these skills (Bell, 2010; Mosier et al., 2016; Moylan, 2008; Nehring & Szczesiul, 2015). Through the PBL curricular process, students are practicing important 21st century learning skills like collaboration, oral and written communication, critical problem solving, and global awareness. However, the research shows that PBL is a complex process for teachers to plan and execute, which is why it is not widely adopted in schools despite the learning benefits for students (Blumenfeld et al., 1991). Organizations like the NTN have developed a whole school model in order to help support teachers and administrators in implementing and sustaining PBL instruction in their schools. While research on the effectiveness of the NTN model is relatively new, the findings that are currently published have shown positive effects on various student outcomes (Carr, 2017; Craig & Marshall, 2019; Mosier et al., 2016; Virtue & Hinnant-Crawford, 2019).

This case study of an NTN program and its graduates addresses a gap in the current research literature on measuring the effects of the NTN model of PBL instruction on students once they have left high school. Current research has provided evidence of how 21st century learning skills are being taught and assessed through PBL, however research on the continued impact PBL instruction had on students after they have graduated from high school and entered into the “real-world” is limited. If the purpose of 21st century learning skills and PBL is to help prepare students for the realities and challenges they will face in modern society, then assessing the effectiveness of 21st century learning and PBL should look beyond students who are currently in the classroom and look at those who have gone through a PBL program, graduated high school, and are now participating in a post-secondary environment. The following research study seeks to look at cohort of students who have graduated from an NTN model high school and hear their perspective of how the NTN model of PBL instruction they received has impacted their lives since graduation.
CHAPTER 3
METHODOLOGY

Purpose of the Study
The purpose of this research study was to determine whether a project-based learning (PBL) academy utilizing the New Tech Network (NTN) model positively shaped the acquisition of 21st century learning skills based on the perceptions of graduates from the academy. This study addressed limited research on the impacts of PBL instruction and the NTN model on students once they have left school. The main objective was to determine, through the perspective of students who have graduated from a NTN academy, whether PBL instruction through the academy had a positive impact on students developing the specific 21st century skills of critical thinking, oral communication, written communication, collaboration, self-reflection, and self-reliance. Additionally, this study determined if NTN graduates feel that they have successfully used these 21st century skills in their lives after high school.

This study was a phenomenological case study of an academy located within a high school in Virginia that implemented the instructional practice of PBL through the NTN model and its impact on building 21st century learning skills in the students that voluntarily went through the program. The study population were students who attended the NTN academy, graduated from the program, and entered post-secondary educational programs or career fields. By researching the perspectives of students who have participated in the program and are now in a post-secondary education setting or workforce, the long-term influence of PBL instruction on developing 21st century learning skills can be determined.

Research Questions
This study of graduates of a New Tech Network program was guided by the following research questions:

1. What was the perceived impact of the New Tech Network model of Project-Based Learning on the development of 21st century learning skills while in high school?
2. What was their perception of how they have utilized the 21st century skills taught in the New Tech Network model in their lives since leaving high school?
Research Design and Methodology

This qualitative study was designed to be a phenomenological case study of one specific NTN program that was utilized in a rural high school in the southeastern United States. The research population were graduates who completed four years of an NTN program, have graduated from high school between the years 2017 and 2020, and are now participating in post-secondary education or workforce. Now that they have graduated from high school, the objective was to understand, through their perspective, if and to what degree their participation in the NTN program influenced their growth in 21st century skills and if and how successfully those skills have been used in their post-secondary lives. Data were collected from research participants through a survey and an interview that asked them to provide their perspective of how their experience in the NTN academy influenced their college and career pathways after high school. The study determined what the student perceptions were about the PBL instruction they received through the NTN model and whether it had a positive or negative impact on their 21st century skills development.

Research Design Justification

According to Creswell and Poth (2018), qualitative research is an appropriate method when a research question needs to be explored and the variables cannot be easily measured. As seen in the research literature, attempts to measure 21st century learning skills like collaboration, effective communication, and problem solving in students have been studied using more qualitative methods. The majority of qualitative analyses of student growth of 21st century learning skills have shown that most assessments are designed to measure core content knowledge and not skills development (Darling-Hammond, 2009; Silva, 2009; Wagner, 2008). Since skills such as a person’s ability to collaborate are difficult to accurately quantify, a qualitative approach is more suited in determining the level of impact that PBL instruction has had on these skills.

Creswell and Poth (2018) define phenomenological research as qualitative research that uses the perspectives of individuals to describe a common experience. By using individual accounts of the common experience, phenomenological research develops a common narrative of all individuals who experience the same phenomena. Phenomenological research is conducted primarily through interviews of the research participants. This study was designed to see the
NTN experience through the perspective of students who participated in the program for four years in high school and have since graduated, and how it has impacted their lives. Using surveys and interviews of participants, the graduates who participated in the NTN program provided their perspective regarding the impact of PBL instruction in two primary areas. First, graduates reflected on whether PBL instruction through the NTN program contributed to their own growth in the 21st century skills of critical thinking, collaboration, written and oral communication, and agency. Second, graduates provided their insight as to whether their participation in the NTN program has had an impact in their successful use of these skills in their post-high school lives.

By performing a phenomenological case study of graduates of an NTN program, their perspectives of how the program did or did not influence their life after high school is highly instructive in determining the long-term impact of NTN programs on a student’s life after high school. Being removed from high school gives them a different perspective about the potential influences and impacts of their experience that current students in the program would not be able to have. According to the NTN (2016), the program is designed to prepare students for success in college and career and is aligned with 21st century learning skills development. Previous research on 21st century learning skills development measured the effect of instructional programs on students currently in school, as was shown in Chapter 2 in the review of research literature. However, now that schools are two decades into the 21st century, different instructional programs that have 21st century skills development as their primary objective have been in practice for some time. Therefore, the perspective of students who have experienced these programs designed to grow defined 21st century skills provides important data for educational researchers and practitioners wanting to know more about the efficacy of these programs.

The defining feature of case study research is the limitation of the research focus on one specific place and timeframe. Case studies are used when an event or phenomena is of specific interest and needs to be described in further detail (Creswell & Poth, 2018). Since NTN affiliated programs are growing in Virginia, a case study approach was necessary to further explore and describe the impact the program had on building a student’s abilities in 21st century learning skills. Studying the NTN program’s effectiveness in 21st century learning is particularly important in Virginia, with the development and implementation of the Virginia Profile of a Graduate as discussed in Chapter 1. The information provided from this case study provides instructive data on the effectiveness of the NTN program and its ability to align itself with
Virginia’s Profile of a Graduate. Since NTN is a nation-wide program of PBL schools, the methods and structure of NTN affiliated schools should be similar across the schools. Impacts of this one PBL program can therefore be transferable to other NTN programs in the state.

This research is described as a phenomenological case study because it is combining two qualitative approaches to gain a greater understanding of the effect the NTN method of PBL instruction has on a student’s 21st century skills. The methodology of the study leans more towards phenomenology with the focus on the participant’s perspectives and lived experiences being the primary means of how data was collected through participant interviews. However, due to the unique nature of the NTN program, methods of case study research are included to center the research on this specific program, and its effect on student skill development.

**Site Selection**

The NTN program selected for this case study was a high school within a rural school district in the southeastern United States. The NTN program was housed inside of a larger high school, and students who participated in the NTN program took PBL driven classes inside the NTN academy and classes in the general population of the larger high school that did not use PBL as their primary instructional strategy. Classes taken through the NTN academy were core instructional classes in the subject areas of Mathematics, Science, English/Language Arts, and Social Sciences. Courses students took outside of the NTN academy were mostly student elective classes necessary to fulfill their graduation requirements. Some NTN classes in the academy combined two core subject areas into one class with multiple instructors working together, while other classes covered only one core subject with one instructor.

This school and program were selected because the PBL academy has been in place since August 2013, allowing for five different cohorts of students to start and complete their high school education through the academy. The consistent operation of this program allowed for a large pool of graduates who have moved into various post-secondary pathways over the last five years. Due to the standardized operation of all NTN programs and the common training that all NTN teachers receive, the program has kept the same format and structure throughout its existence.

The term “academy” was applied in this high school to the NTN program to differentiate it from the larger high school it resided in due to the implementation of PBL instruction in the
NTN academy. Only a portion of the students who attended the high school were students in the NTN academy with the size of each cohort capped at 100 students each year. With an average total student population of 1,100 students during the years of 2013-2020, approximately one third of the student population of the high school were affiliated with the NTN academy.

Students voluntarily applied to join the NTN academy during the spring of their 8th grade year and began classes in the program in the fall of their 9th grade year. The NTN academy did not use any type of selection criteria to fill the slots for each 9th grade cohort; students were accepted into the program in the order they applied. Students made a commitment to remain in the NTN program for one year and could choose to remain for the following year or exit the program.

In this NTN academy, five cohorts of students have graduated from high school since the program began in the Fall of 2013. The first cohort of students who completed the program graduated from high school in 2017, and the latest cohort graduated in 2021. Since graduation, students who participated in the academy have entered the workforce, enlisted in the military, or enrolled in a post-secondary higher education institution. By having students who are removed from high school for at most four years allows for more opportunities for graduates to use 21st century after graduation. Comparisons between cohort groups will not be made in this study since the NTN program studied has followed the same format since its inception.

**Participant Selection**

Individuals who participated in the NTN program were eligible to participate in the study. Potential participants were identified in collaboration with the school system where the high school resides to generate a roster of former students who participated in the program. Each cohort of students started with a maximum of 100 students in the 9th grade, although the total number of students who started in the academy varied from year to year. The first class entered the program in the Fall semester of 2013, and successive cohorts started each year after. The inclusionary criteria were persons who participated and successfully completed all four years of the program and have graduated from high school. Any individuals who were enrolled in the high school but did not participate in the NTN program or were current students in the program were excluded as potential participants. Individuals who did not complete four years of the NTN program were also excluded as participants. Students who graduated in 2021 were excluded from
the study, since the COVID-19 pandemic forced their classes to be conducted online during the last half of their junior year and most of their senior year. Because of this disruption to their normal academic modality, their experiences were anticipated to not be comparable to other cohorts of students who experienced four years of in-person school. After lists were shared by the school division, reliable contact information of graduates could only be obtained for 174 potential participants. Invitations to participate in the research study were sent to all 174 identified participants. From this population, 20 participants responded to the initial survey portion of the study, and 12 participated in the interview.

**Data Collection Procedures**

Participants for the research study were identified in collaboration with personnel from the school system by developing a list of former students who participated in and completed the NTN program. Once research participants were identified, they were contacted through email and social media platforms to provide information about the study and invite them to participate in the survey.

Data were collected for this phenomenological case study through surveys and interviews conducted with participants who agreed to participate in the study. The survey instrument (see Appendix B) was designed to be an original instrument that is unique to this case study. Participants were asked to answer questions related to their perceptions of growth in 21st century learning skills due to their participation in the NTN program in high school, and their perceptions of how much impact it has had on their life after high school. The 21st century skills participants were asked to evaluate were chosen based on skills that were frequently found in the research literature and identified by the NTN as objectives in their program. Participants were asked to assess where they believed they were in each skill before entering the NTN program as a 9th grade student, and then to assess their abilities in each skill after completing the program at the end of their 12th grade year. A Likert Scale system was developed for participants to indicate where they assessed their abilities in each 21st century skill. The survey then asked participants to identify how often and how successfully they have used each 21st century skill since graduation from high school. A Likert Scale system was also developed for participants to indicate their response for each of these questions.
At the end of the survey, participants were asked if they would be willing to be considered for a follow up interview as part of the study. Participants were only interviewed once as a part of this study. From the original survey population, 17 participants opted to participate in an interview. All 17 participants were contacted to schedule a time to conduct the interview through Zoom video conferencing software, and 12 participants of the 17 followed up with the email and participated in an interview for the case study.

The purpose of interviews was to gain a deeper understanding of the perception the research participants have about the impact of the NTN program. The interview protocol questions that were developed elicited open-ended responses about graduate perceptions of how the program influenced their use of 21st century skills after high school, and findings will be generated based on the responses they provide. Due to the ongoing Covid-19 pandemic, the setting for each interview was to be through Zoom video conferencing software. Each individual conference call had the video feature disabled by the researcher, and each participant was given a number prior to logging into the conference call so their name was not identified in the transcription of the call. These steps were intended to protect the anonymity of each participant. Each interview was recorded so that responses of the participants can be transcribed.

Instrument Design and Validation

Creswell and Creswell (2018) state that a survey should be used as a research instrument when the research is seeking to determine the attitudes or opinions of a population. In this study, the research questions are seeking to determine the perceptions of former students who participated in an NTN program, necessitating the need of a survey instrument (see Appendix C). Compared to other methods of data collection, a survey instrument is preferable due to the ability to gather data from a larger sample in as efficient a manner as possible.

Questions 1 and 2 in the survey were designed to gain basic demographic information about the participants post-secondary pathways and determine the year they graduated from high school and the NTN program. Questions 3 through 6 ask the participants to rank their abilities in a list of 21st century learning skills that are identified by the research as being essential skills that students grow in through PBL instruction. At the end of the survey, students are asked if they would be willing to participate in a follow up interview.
Creswell and Poth (2018) establish several criteria for an effective interview design in a qualitative research study. Questions should be centered around the research questions and phrased in a way so that participants can understand. Interview questions should be designed to elicit open ended responses from the participants. Researchers should develop an interview protocol before conducting interviews and use the protocol during the interview. They suggest the first questions developed in an interview protocol should be designed to get the participant to become comfortable with the interviewer and provide more detailed answers. The purpose of the interview protocol (see Appendix D) that was designed is to get a deeper understanding of the impact the NTN program had on participant’s 21st century skills development. Each question is open-ended and is tied into the skills identified in the research literature as those that students are expected to use in PBL instruction.

The questions asked in both the survey and interview to the participants were designed to answer the two research questions of this case study. Table 1 indicates the survey and interview questions that are paired with each research question.

Data Analysis

For the survey responses, data was analyzed through descriptive statistical analysis. Inferential analysis of the data is not required, since the research questions are not requiring a comparison of one group to another. For each question in the survey, the rankings provided by the participants will be averaged together to show the central tendency of the respondents and how they perceived the impact of PBL and the NTN program on their 21st century skill development.

Creswell and Poth (2018) stated that data analysis in qualitative research studies requires organization of the data and then synthesizing the data into themes through codes. Miles et al. (2020) describes the purpose of coding qualitative data as the primary means of a researcher to analyze data, develop common themes, and draw conclusions from their research. For this study, interview data was analyzed using the coding method described by Miles et al. (2020). First cycle coding of the data was completed using concept coding that defined broader themes mentioned by the interview participants. Then second cycle coding was performed on the data to compare the data provided by each interview participant, and determine emerging themes that developed from their responses.
## Table 1

**Survey and Interview Questions and the Research Questions They Address**

<table>
<thead>
<tr>
<th>Research Question #1: What was the perceived impact of the New Tech Network model of Project-Based Learning on the development of 21st century learning skills while in high school?</th>
<th>Survey Questions that Answer the Research Question</th>
<th>Interview Questions that Answer the Research Question</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before starting high school, how would you rank your abilities in the following categories? (Critical thinking, collaboration, written communication, oral communication, self-reflection, self-reliance)</td>
<td>What impact did the NTN academy have on how you handled a situation that required you to take ownership of a problem?</td>
<td>What impact would you say your experience at the NTN academy has had on your collaboration abilities?</td>
</tr>
<tr>
<td>After completing the NTN program in high school, how would you rank your abilities in the following categories? (Critical thinking, collaboration, written communication, oral communication, self-reflection, self-reliance)</td>
<td></td>
<td>What impact would you say that your experience at the NTN academy has had on your communication abilities?</td>
</tr>
<tr>
<td>How comfortable are you in interacting and working with someone who is of a different background than you? How comfortable are you with seeking out opinions and thoughts from multiple perspectives?</td>
<td></td>
<td>How comfortable are you in interacting and working with someone who is of a different background than you? How comfortable are you with seeking out opinions and thoughts from multiple perspectives?</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Research Question #2: What was their perception of how they have utilized the 21st century skills taught in the New Tech Network model in their lives since leaving high school?</th>
<th>Survey Questions that Answer the Research Question</th>
<th>Interview Questions that Answer the Research Question</th>
</tr>
</thead>
<tbody>
<tr>
<td>How often have you used the following skills in your life since graduation? (Critical thinking, collaboration, written communication, oral communication, self-reflection, self-reliance)</td>
<td>What impact did the NTN academy have on the decisions you made in pursuing the college and/or career opportunities you took?</td>
<td>In the career or college setting you have worked in since high school, how much have you had to use the skills of collaboration, communication, and problem solving?</td>
</tr>
<tr>
<td>How successfully have you used each of the following skills since high school? (Critical thinking, collaboration, written communication, oral communication, self-reflection, self-reliance)</td>
<td></td>
<td>What is your overall impression of the impact that the NTN program has had on your post-secondary life?</td>
</tr>
</tbody>
</table>
Interviews took place utilizing Zoom conference call software. Zoom offers audio transcriptions as part of the software package, and this feature was used to transcribe the interviews that are conducted with the participants. After each interview was conducted, the transcription of the interview was downloaded, and the content pasted electronically in a single Microsoft Excel document. A spreadsheet tab was created for each interview question, and each participant’s transcribed response to the question was copied into a column on the spreadsheet. This document was used to analyze the interview data and search for the *a priori* codes based on the research questions. Using the find and search feature of Microsoft Excel, each code was entered into the document and searched for. Each code was highlighted to organize the data around each of the themes, aiding in the final analysis of the research questions.

It was anticipated that as the researcher collects the data, the *a priori* codes may evolve during data analysis. Miles et al. (2020) described this as a natural part of qualitative studies. Some codes that are initially seen as pertinent to the study may not apply once interviews are conducted. Other *a priori* codes may not need to be discarded, but based on the participant responses may need to be changed in order to best reflect the words of the participants.

**Confidentiality and Treatment of Data**

Prior to starting the research, the researcher completed a course on social and behavioral research through the Collaborative Institutional Training Initiative (CITI) on September, 2019 (see Appendix A). Additionally, prior to starting the study an application for the study was submitted to the Institutional Review Board for Virginia Tech, and approval for the study was granted in January, 2022 (see Appendix B). All data collected through individual participant surveys and interviews was treated to maintain participant confidentiality. Surveys did not collect names or personal demographic information that is not pertinent to the research study. Pseudonyms were created for each individual participant in the interviews so that their real name will not be disclosed. Data from the transcripts of each interview was stored on a password protected computer that is only accessed by the researcher. All files were kept for a period of one year and then destroyed.
Summary

This phenomenological case study of the WTA program focuses on the perceptions of graduates of the program who are now four years removed from high school, and their perceptions of how the program has or has not influence their application of 21st century learning skills since they have left high school. Through individual interviews with the study participants, themes in the responses were developed and analyzed in order to develop conclusions about the effectiveness of the PBL model used by NTN affiliated schools.
CHAPTER 4
DATA AND FINDINGS

Purpose of the Study

The purpose of this research study was to determine whether a project-based learning (PBL) academy utilizing the New Tech Network (NTN) model positively shaped the acquisition of 21st century learning skills based on the perceptions of graduates from the academy. This study addressed limited research on the impacts of PBL instruction and the NTN model on students once they have left school. The main objective was to determine, through the perspective of students who have graduated from a NTN academy, whether PBL instruction through the academy had a positive impact on students developing the specific 21st century skills of critical thinking, oral communication, written communication, collaboration, self-reflection, and self-reliance. Additionally, this study determined if NTN graduates feel that they have successfully used these 21st century skills in their lives after high school.

This study was a phenomenological case study of an academy located within a high school in Virginia that implemented the instructional practice of PBL through the NTN model and its impact on building 21st century learning skills in the students that voluntarily went through the program. The study population were students who attended the NTN academy, graduated from the program, and entered post-secondary educational programs or career fields. By researching the perspectives of students who have participated in the program and are now in a post-secondary education setting or workforce, the long-term influence of PBL instruction on developing 21st century learning skills can be determined.

Research Questions

This study of graduates of a New Tech Network program was guided by the following research questions:

1. What was the perceived impact of the New Tech Network model of Project-Based Learning on the development of 21st century learning skills while in high school?
2. What was their perception of how they have utilized the 21st century skills taught in the New Tech Network model in their lives since leaving high school?
Overview of Study Participants

Invitations to participate in the study were sent to individuals who completed the NTN program at the school being studied and graduated between the years 2017 and 2020. Prior to starting the study, the researcher contacted the school division where the NTN academy was located and requested assistance in developing a list of graduates of the NTN academy who graduated between the focus years of the study. School division personnel provided a list of students from each class between the years of 2017 and 2020 who graduated from the NTN program.

An invitation to participate in the study was posted on the case study school’s Twitter account asking for graduates of the NTN program who would be willing to participate in the study. Since that invitation did not generate any initial responses to the survey, invitations to participate in the study were sent through a direct private message to the Facebook accounts of 174 individuals who were identified as graduates of the program according to lists provided by the participating school division, with a follow up invitation sent to those who did not respond. Facebook was used instead of email because personal email accounts of the graduates were unknown, and Facebook allowed for the researcher to verify based on information listed on their page were graduates of the case study school.

Of the individuals who were invited to participate through the direct invitations on social media, 20 individuals responded and consented to participate in the survey portion of the study and completed the survey. After completing the survey, participants were asked if they would be willing to participate in a follow up interview where they were able to provide more detailed information about their perceptions of the NTN program and if it had an impact on their growth in 21st century skills and how. If participants agreed to participate in an interview, they were asked to provide an email address so that the researcher could schedule an interview. From the survey participants, 17 individuals indicated on the survey they would be willing to participate in an interview, however only 12 followed up and participated in an interview with the researcher.

Survey Data

The survey was divided into two parts. The first part consisted of general demographic information of each of the participants. The second part asked participants to respond to
questions that focused on their perceptions of 21st century skill development both during their time in high school and after high school.

*Part I: Demographic Information*

The first part of the survey asked participants for specific demographic information. The first question in the survey (see Appendix C) asked participants to identify the college or career pathway they took after graduating from the New Tech Network (NTN) program. Respondents were asked to select all options that applied, so the total number of responses to this question was more than the total number of participants. For example, a participant who entered the military immediately after high school and then also enrolled in a four-year degree program would have selected both “Enlisted in the Military” and “Went into a Bachelor’s degree program (4-year degree)”. Table 2 lists the number of participants and the pathways they identified. Responses showed that the participants went into a variety of different pathways after high school. The majority of respondents to the survey indicated that they enrolled into some type of post-secondary education program after high school, with seven respondents going into a two-year college program and twelve participating in a four-year college program. Other participants indicated they went into the workforce after high school, with two respondents indicating that they enlisted in a branch of the United States military and four indicating they went into the workforce.

**Table 2**

*College or Career Pathway for NTN Participants After High School*

<table>
<thead>
<tr>
<th>Pathway</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Went into the workforce</td>
<td>4</td>
<td>20</td>
</tr>
<tr>
<td>Enlisted in the military</td>
<td>2</td>
<td>10</td>
</tr>
<tr>
<td>Attended a trade school</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Went into an Associate’s degree program (2-year degree)</td>
<td>7</td>
<td>35</td>
</tr>
<tr>
<td>Went into a Bachelor’s degree program (4-year degree)</td>
<td>12</td>
<td>60</td>
</tr>
</tbody>
</table>
Participants were then asked to select which year they completed the NTN program and graduated from high school. Table 3 shows the total number of participants who graduated in each calendar year, and the overall percentage of each graduation year in the study. Of the survey participants, 17 stated that they completed the NTN program in 2017, two completed in 2018, one completed in 2019, and no participants completed in 2020.

Table 3

<table>
<thead>
<tr>
<th>Year of Completion</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>2017</td>
<td>17</td>
<td>85</td>
</tr>
<tr>
<td>2018</td>
<td>2</td>
<td>10</td>
</tr>
<tr>
<td>2019</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>2020</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Part II: Perceptions of NTN Program

Participants then responded to four questions that asked them to rank their ability and use of selected 21st century skills that were part of the NTN program. A Likert Scale was used on each question to rank their perception of each skill. For each question, participants were asked to rank and assess each of the following skills: problem-solving, collaboration, written communication, oral communication, self-reflection, and self-reliance. The following data is based on the responses to each question in Part II of the survey.

Before starting high school, how would you rank your abilities in the following categories?

Table 4 lists the 21st century skills that respondents were asked to reflect on, and the rankings they assigned to themselves. In the area of critical thinking, seven respondents scored themselves on the undeveloped end of the scale with a score of 1 or 2, and seven respondents scored themselves on the more advanced end of the scale assigning themselves a score of 4 or 5. In the area of collaboration, the majority of respondents (n=13) ranked themselves towards the undeveloped end of the scale by assigning themselves with a score of 1 or 2. Only three respondents scored their collaboration abilities on the advanced end before high school. With written communication, more respondents (n=10) scored their abilities towards the advanced end.
of the range with a score of 4 or 5 compared to other skill areas, while in the area of oral communication the majority of respondents (n=12) scored their ability towards the undeveloped range of the scale with a score of 1 or 2. Respondents ranked themselves more towards undeveloped on the skill of self-reflection (n=13) prior to high school. Finally, respondents split equally between the undeveloped end (n=8) and advanced end (n=8) of the scales on their assessment of their ability to be self-reliant before high school.

Table 4

*Self-perception of NTN Academy Student Ability in 21st Century Learning Skills Prior to Starting High School*

<table>
<thead>
<tr>
<th>Skill</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Critical Thinking and Problem Solving</td>
<td>3</td>
<td>15</td>
<td>4</td>
<td>20</td>
<td>6</td>
<td>30</td>
</tr>
<tr>
<td>Collaboration</td>
<td>5</td>
<td>25</td>
<td>8</td>
<td>40</td>
<td>4</td>
<td>20</td>
</tr>
<tr>
<td>Written Communication</td>
<td>1</td>
<td>5</td>
<td>6</td>
<td>30</td>
<td>3</td>
<td>15</td>
</tr>
<tr>
<td>Oral Communication</td>
<td>4</td>
<td>20</td>
<td>8</td>
<td>40</td>
<td>6</td>
<td>30</td>
</tr>
<tr>
<td>Self-reflection</td>
<td>3</td>
<td>15</td>
<td>10</td>
<td>50</td>
<td>2</td>
<td>10</td>
</tr>
<tr>
<td>Self-reliance</td>
<td>1</td>
<td>5</td>
<td>7</td>
<td>35</td>
<td>4</td>
<td>20</td>
</tr>
</tbody>
</table>

*Note.* Likert Scale rankings based on 1=Undeveloped and 5=Advanced.

After completing the NTN program in high school, how would you rank your abilities in the following categories?

Respondents were then asked to rank their abilities in the same 21st century learning skills after completing the NTN program in high school. Table 5 lists the frequency and percentage of each response given by the survey participants. In every skill, no respondent indicated that they were at an undeveloped level after completing the NTN program. One respondent gave themselves a ranking of 2 on all the 21st century skills except collaboration, where two respondents assigned themselves that ranking. The rest of the respondents ranked their skill level at a “3” or higher after completing the NTN program. The two specific skill categories that
received the most advanced rankings were written communication and self-reliance (n=12). The skills of critical thinking/problem solving and self-reflection received the fewest advanced rankings (n=7) when compared to the other 21st century skills study participants were asked to reflect on.

Table 5

Self-Perception of NTN Academy Students Ability in 21st Century Learning Skills After Completing High School

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>%</td>
<td>n</td>
<td>%</td>
<td>n</td>
</tr>
<tr>
<td>Critical Thinking and Problem Solving</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Collaboration</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>10</td>
<td>3</td>
</tr>
<tr>
<td>Written Communication</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Oral Communication</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Self-reflection</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td>Self-reliance</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>5</td>
<td>6</td>
</tr>
</tbody>
</table>

Note. Likert Scale rankings based on 1=Undeveloped and 5=Advanced.

How often have you used the following skills in your life since high school?

To determine if former NTN students used 21st century skills after high school, respondents were first asked how often they used each of the identified 21st century learning skills in their daily lives since high school. Table 6 lists the frequency and percentage of each response to the question. In every 21st century learning skill surveyed, no respondents indicated that they “never” used any of the skills in their lives since high school. In only one skill, written communication, did respondents indicate that they only used it once a month (n=3). For the skills of critical thinking, collaboration, oral communication, self-reflection, and self-reliance the survey respondents stated that they used each of these 21st century skills either once a week or daily. Respondents indicated that problem solving and oral communication were the two most frequently used skills in their post-high school lives, with 90% saying they use critical thinking
and problem solving daily, and 95% saying they use oral communication each day. Self-reflection and collaboration were the two skills respondents indicated they use the least. With self-reflection, eight indicated they use the skill at least once a week and twelve stating that they use the skill once a day. Collaboration was slightly higher, with seven stating that they use that skill once a week and thirteen using it once a day.

Table 6

Frequency of 21st Century Skills Usage by NTN Graduates

<table>
<thead>
<tr>
<th></th>
<th>Never</th>
<th></th>
<th>At least once a</th>
<th></th>
<th>At least once a</th>
<th></th>
<th>At least once a</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>%</td>
<td>month</td>
<td>n</td>
<td>%</td>
<td>n</td>
<td>%</td>
<td>n</td>
</tr>
<tr>
<td>Critical thinking &amp; Problem solving</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>10</td>
<td>18</td>
</tr>
<tr>
<td>Collaboration</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>7</td>
<td>35</td>
<td>13</td>
</tr>
<tr>
<td>Written communication</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>15</td>
<td>1</td>
<td>2</td>
<td>10</td>
<td>15</td>
</tr>
<tr>
<td>Oral communication</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>5</td>
<td>19</td>
</tr>
<tr>
<td>Self-reflection</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>8</td>
<td>40</td>
<td>12</td>
</tr>
<tr>
<td>Self-reliance</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>15</td>
<td>17</td>
</tr>
</tbody>
</table>

How successfully have you used each of the skills since high school?

Survey participants were finally asked to rank how successfully they feel that they have used each of the 21st century learning skills since high school by using a Likert Scale where 1 equaled unsuccessfully and 5 equaled successfully. Table 7 lists the frequency and percentage of responses each participant selected on the question. No respondents indicated that they felt they were unsuccessful in using each of the skills in the survey with all skill categories receiving no “1” responses. The skills of problem solving, collaboration, self-reflection, and self-reliance had responses that were ranked most frequently on the higher end of the scale indicating participants felt they had successfully used the skills since high school, with each skill receiving a total of 14 responses that were either a “4” or “5” on the Likert Scale. Respondents rated critical thinking and problem solving as the skill they felt they were the most successful in using, with 13 total
respondents rating it the highest. Written and oral communication were rated by survey respondents slightly lower on the scale, with thirteen respondents rating their implementation of each of these skills on the successful end of the scale. Collaboration received the most responses on the unsuccessful lower end of the scale, with three respondents rating their current implementation of the skill with a “2”.

Table 7

| How NTN Graduates Perceive their Ability to use 21st Century Skills in Daily Lives |
|--------------------------------------|---|---|---|---|---|
|                                      | 1 | 2 | 3 | 4 | 5 |
| Critical thinking & Problem-solving  | n | % | n | % | n | % | n | % |
| Collaboration                        | 0 | 0 | 2 | 10| 4 | 20| 1 | 5 |
| Written Communication                | 0 | 0 | 2 | 10| 5 | 25| 2 | 10|
| Oral Communication                   | 0 | 0 | 2 | 10| 5 | 25| 2 | 10|
| Self-reflection                      | 0 | 0 | 2 | 10| 4 | 20| 3 | 15|
| Self-reliance                        | 0 | 0 | 2 | 10| 4 | 20| 3 | 15|

Note. Likert Scale rankings based on 1=Unsuccessful and 5=Successful.

Interview Data

From the original 20 participants who completed the survey, 12 individuals participated in an interview that sought to gain deeper insights into their perceptions of how the NTN program contributed to their growth in different 21st century skills. As shown in Table 1 in Chapter 3, there were four specific questions in the interview protocol (see Appendix D) that addressed the research question of whether graduates of the NTN academy perceived that their participation in the NTN program influenced growth in their 21st century skills and there were three interview questions that addressed whether graduates of the NTN program felt that they used the 21st century skills they learned in their lives today. The following were the findings based on the responses to each of the questions in order from when they were asked of all the interview participants.
Interview Question 1: What impact did the NTN academy have on the decisions you made in pursuing the college and/or career opportunities you took after high school?

Interview participants were asked to describe the impact participation in the NTN academy had on the college or career opportunities they pursued after high school. The graduates gave several responses about the level of impact NTN had on the direction they took after high school. While some attributed credit to the NTN program for their path after high school, others saw limited or no impact of the NTN program on the college and career path they took after high school.

Those who reported positive impacts of the NTN program on their post-secondary college and career paths usually highlighted the impact the NTN program had on their decisions to either go or persist in college. Two participants cited the skills they learned through their time in the NTN program and how it influenced the college decisions they made. Graduate 3 highlighted the growth they made in oral communication during their time in the NTN program, and believed that growth made an impact in where they wanted to attend college after high school:

I really developed those skills, especially public speaking in the NTN academy, and I think that helped me in my decision of [if] I wanted to go to a college that emphasized not only group work and community, but also public speaking, debating, public speaking aspects like that.

Graduate 10 believed that their participation in the NTN program also influenced what they were looking for in college as well. Because they enjoyed the collaborative nature of the NTN academy in high school, they looked for a college that used more collaborative methods.

Participants tended to link the skills they believed they learned in the NTN program with persistence in college rather than influencing their decision to attend or not attend college. Graduate 1 credited their participation in the NTN academy for preparing them for success in college by improving their personal agency:

And I guess it impacted because it taught me to be a bit more responsible. I think at the time I was not that way, and I think afterwards I was like, “Whoa, I need to take a lot more responsibility for what I do.” So, I think the NTN academy was a good starter program towards what would eventually be college. If not, it would probably have been a rude awakening for me especially.
Graduate 11 also believed that the NTN program helped provide them the responsibility they needed be successful in college. They felt that the program provided them the independence they needed to be able to manage time and accomplish the tasks they needed in college. Graduate 7 credited the emphasis on collaboration in the NTN academy and how it helped them persist in college. They stated that with everything being “collaboration based” in the NTN program it was “very similar” to what they experienced in the college they attended. Graduate 12 credited the NTN program for providing them the confidence they needed to be successful in college. Graduate 3 believed their experience in the NTN program gave them the confidence to voluntarily step up and work on several committees as both a participant and as a chair. They stated that they were willing to do this because through their experience in the NTN program, “I knew I could handle the role of being a manager, and I knew how to give other people tasks and trust that those people will do those tasks and how to handle if they didn’t.”

Some participants also attributed the skills they learned in the NTN program to the career pathways they took after high school. Graduate 4 referenced their decision to enlist in the military after high school and how the skills they learned in the NTN program transferred. Specifically, they stated that their abilities in collaboration they gained from the NTN academy influenced their time in the military because, “everything’s more collaborative [right there] in the military.” Graduate 6 also credited the collaborative nature of the NTN program in influencing their decision to enter their chosen field of interior design. They stated that, “the group project aspect of it made me realize that I wanted to be around people and be able to, like, be in a team environment.” Graduate 6 also mentioned that focus on creativity and thinking “outside of the box” in the NTN program contributed to their desire to pursue the career path they went into. Graduate 7 mentioned the skill of communication, particularly oral communication, and how that emphasis influenced their decision to enter the field of marketing. Graduate 9 cited a project they worked on during their junior and senior years that sparked their interest to pursue a career in nursing. They stated that because of this project, they were inspired to continue to learn more about the care of stroke patients and that was where they work today.

Those who attributed no or little impact of the NTN program on their college and career pathways tended to focus on other factors that had a greater impact on their post-secondary decisions. Graduate 2 stated that the NTN program did not influence their decision to either go to college or where they enrolled in college. Their decision centered more around scholarship
opportunities rather than finding a post-secondary school that fit what they experienced in the NTN program. Graduate 8 expressed a similar sentiment, stating they had already decided that they wanted to go to college before the NTN program. Graduate 5 did not see that the NTN program influenced their decision to go into the field of nursing because they “always knew” they wanted to be a nurse. Although it did not impact their career decision, they did indicate that NTN helped with their ability to interact with patients in their career.

**Table 8**

*Frequency of Responses According to Common Themes of Interview Question 1*

<table>
<thead>
<tr>
<th>Theme</th>
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<tbody>
<tr>
<td>Influenced their college decisions</td>
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</tr>
<tr>
<td>Persist in college</td>
<td>6</td>
</tr>
<tr>
<td>Influenced their career pathway</td>
<td>4</td>
</tr>
<tr>
<td>No effect on their college or career choices</td>
<td>3</td>
</tr>
</tbody>
</table>

*Interview Question 2: What impact did the NTN academy have on how you handled a situation that required you to take ownership of a problem?*

Each interview participant was asked what level of impact that the NTN program had on their ability to take ownership of a problem. Every graduate noted that the process of working in a PBL environment during their time in high school through the NTN academy had a positive impact in building their capacity for personal responsibility. The aspect of the PBL process that participants cited the most in terms of influencing their ability to accept personal responsibility was the fact that in each project they worked on they had a specific role or task they were responsible for. Graduate 5 stated that in the group projects, “everybody had their own kind of own responsibility for the project…if something goes wrong…I have to take accountability.” Graduates 4 and 12 echoed this same sentiment by saying that when they were in the NTN academy everyone was, “responsible for our own actions.” Graduate 6 equated ownership of a problem with professionalism:

So, I think the NTN academy really helped kind of teach me how to approach a problem in a more professional way, because probably [myself in high school] would have been
like, ‘Well, you just put it in there wrong.’ But going through the group project and having to be able to problem solve and own up to the problems or the mistakes that you make help or helped me to not just say, “Well, you didn’t do it right” and be more professional about it.

Graduate 1 compared taking ownership in a project to “pulling your weight” by making sure that their part of the task helped accomplish the goal of the entire group.

The NTN graduates also spoke about the differences of working in a group setting as compared to an individual setting, and how the group setting created a different type of responsibility for them. When thinking about their educational experiences before starting the NTN academy, Graduate 1 recalled doing activities that were called projects in elementary and middle school, but those projects usually were completed individually rather than as a group. Graduate 3 compared the differences in failure between the group and individual assignments:

I think one of the best things that the NTN academy taught me was how to handle a problem, especially a failure in a group setting, because when you fail on your own you can take your sole responsibility for it, and you can learn from those actions. But once someone else fails or a group fails it’s something that’s completely different if you haven’t experienced that before.

Graduate 3 went on to say that they learned through the group process in the NTN academy that owning mistakes they made and failing at times was a learning opportunity and helped them later when they worked in group projects in college. Several

Finally, several participants claimed a connection between personal responsibility and greater leadership within the PBL process in the NTN program. They found that having to work in diverse groups to complete projects caused them to learn how to not just take ownership of their individual success, but also take ownership of the group’s success as well. In some cases, this meant that they had to adjust how they might work within a group to create a group dynamic that could complete a project successfully. Graduate 11 said that the NTN program, “definitely made me more comfortable being in a leadership position above anything else, because I’ve just always been very reserved, and I knew that I had leadership like tendencies, but I wasn’t vocal about them.” Graduate 2 stated that they had to work with many different people who had different personalities from their own throughout their time in the NTN academy, but they felt that they learned how to work with different people by changing how they interacted with others.
in the group so that it was complementary with others in the group. Others took this further by learning how to leverage the different talents of others when assigning group tasks and responsibilities. Graduate 7 stated they learned how to take ownership of group success by breaking up tasks in a project into different parts, and assigning those tasks based on the strengths of individuals in the group. Graduate 3 felt that when tasked as a group manager in a project while at the NTN academy they learned a different level of responsibility for the success or failure of the project, but this pressure helped when they were tasked to be in a similar role in college. Through their experience in high school, they learned how to manage the expectations they had for their fellow group members, and not overload them with tasks or timelines that would set them up for failure. As a leader of a group, they felt a sense of ownership of the success or failure of the project based on their ability to successfully lead the group.

Table 9

<table>
<thead>
<tr>
<th>Frequency of Responses According to Common Themes of Interview Question 2</th>
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<tbody>
<tr>
<td>n</td>
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<tr>
<td>Personal responsibility/ownership</td>
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<tr>
<td>Working within a collaborative group</td>
</tr>
<tr>
<td>Leadership</td>
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</tbody>
</table>

Interview Question 3: What impact would you say your experience at the NTN academy has had on your collaboration abilities?

Since student collaboration in the PBL process was a major tenant of the NTN philosophy, interview participants were asked to describe what impact they felt that their experience in the NTN academy had on their ability to collaborate. Interview responses showed that while collaboration was a skill they felt they were the least experienced in prior to high school, through their experiences both in the NTN program and after they saw how important the skill of collaboration was in their post-secondary lives.

Six respondents in the interviews indicated that when they entered the NTN program as freshmen, they believed that they were not naturally inclined to branch out and work with other students. Graduate 2 said that they were a very “individual person” and “didn’t like a lot of group
work” when they entered high school. Graduate 3 labeled themselves as an “introvert” when they began the program, while Graduate 4 described themselves as “deep into my shell” and Graduate 5 identified themselves as “nervous”. Graduate 6 said they were “not a group project person” prior to entering the program and preferred to do things by themselves. Graduate 11 said they were an “introvert” who “barely liked leaving home” and having to collaborate with other students at the beginning of their time in the NTN program was “very uncomfortable” for them.

Participants went on to describe how their perception of collaboration and group work changed as they participated in the NTN program. Graduate 4 credited the collaborative atmosphere of the program in turning them into a “social butterfly” and being able to communicate and work with other students. Graduate 5 cited the frequent presentations they did and being able to interact with different outside community members for helping grow their collaboration skills. Graduate 1 reflected on how the collaborative aspect of the NTN program allowed them to broaden their perspective and see viewpoints other than their own. Prior to starting the program, they felt they were not very receptive to other people’s ideas, but through collaboration learned to embrace different viewpoints. They said, “It allowed me to accept other people for their opinions and ideas and realize at the end of the day it’s not muddying my ‘quote/unquote’ perfect plan.” Graduate 3 shared a similar revelation during their time in the program:

(It) changed my attitude on (collaboration) because I realized that instead of giving 100% yourself, giving even 80% of yourself with other people giving 80% is so much more than anything I could have ever done. And I consider myself to be a smart student, but even then, having other people around you is so much better just because you have the ability to share your ideas and bounce your ideas off people, and constructive criticism is a huge thing.

Graduate 11 reflected that they had both good and bad experiences collaborating with classmates during their time in the program, but being able to collaborate with both students and teachers allowed them to become more comfortable with it. Graduate 12 shared a similar sentiment when talking about collaboration by saying it was difficult at times because there were group members who would “slack off”, but being able to work with other individuals and not having to “rely on your own self” for everything made the experience better.
NTN graduate interview participants highlighted how collaboration was a skill they used frequently in their lives since high school as well. By practicing these skills frequently in high school, they felt more prepared to work in collaborative groups in their careers and college. Graduate 6 mentioned that the NTN program “expanded” their ability to collaborate which they felt has translated to their current career that requires them to work with different stakeholders in order to satisfy the needs of their clients. Graduate 7 stated that there “wasn’t a single class in college” that they took that did not utilize collaboration in some fashion. They cited one specific example where they had to work with a group of students to provide consultation to a company during their senior year. Graduate 3 spoke about having to collaborate with their co-workers in their job and making sure everyone can work well together.

In these collaborative experiences the participants spoke about, they also spoke about being able to successfully navigate collaborative experiences that they have participated in since high school. Graduate 2 spoke about a collaborative advocacy project they were involved with in their college, and how several group members were not contributing their part to the project. They said that the NTN program taught them that it was “okay” when this happened, and how to manage it successfully when it did. Graduate 7 mentioned they noticed how their ability to work within the group was more advanced than their peers in their college classes. They felt that it was obvious that some of the people they had to work with in college did not have the same level or exposure to collaboration as they had by going through the NTN program.

Table 10

<table>
<thead>
<tr>
<th>Frequency of Responses According to Common Themes of Interview Question 3</th>
<th>n</th>
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</thead>
<tbody>
<tr>
<td>Dislike/fear of collaboration prior to NTN</td>
<td>6</td>
</tr>
<tr>
<td>Change in perception of collaboration</td>
<td>6</td>
</tr>
<tr>
<td>Frequency of collaboration in post-secondary experiences</td>
<td>3</td>
</tr>
<tr>
<td>Comfort with collaboration since high school</td>
<td>2</td>
</tr>
</tbody>
</table>
Interview Question 4: What impact would you say that your experience at the NTN academy has had on your communication abilities?

Participants were asked what impact the NTN program had on their ability to communicate in both written and oral forms. While the NTN graduates spoke about growth in both forms of communication, the graduates spoke frequently about how they saw their oral communication skills grow during their time in high school, and how it has helped them in the college and career pathways they took after graduation.

Interview participant’s view of their growth in written communication were mixed. Four graduates felt that their written communication skills were already highly developed before entering high school, so there was little room for growth in the NTN academy. Graduate 1 expressed this sentiment when they stated that they felt they were always able to write and communicate through writing well. Graduate 8 felt that while the NTN program helped them in their writing abilities some, it was college that provided them more growth in this area:

We did write, but I think college was the thing that really helped with my written (communication) just because I was writing all of the time. The NTN program helped me as far as like English papers, like short-term papers and things like that. But going to college really benefited my writing, because I was writing 10 or 20 page papers.

Other participants mentioned their disinterest in writing. Graduate 4 stated that they were never a “big fan” of writing, so they were unsure that the NTN program had any impact on their abilities. Graduate 3 also expressed their opinion that their lack of natural ability in writing led to low growth in this ability.

Six of the NTN graduates interview perceived some growth in their written communication skills and credited the NTN program. Graduate 9 referenced the fact that with nearly every project there was a written essay that had to be submitted, so that helped their writing ability improve. Graduate 2 spoke about majoring in writing in college and how the NTN program helped them grow as a writer during high school. Other participants talked about how the NTN program helped them grow in their professionalism with their writing. Graduate 5 credited the NTN program for helping them learn how to communicate professionally with their emails. Graduate 6 also mentioned professional communication with their writing, stating that most of the written communication they do currently is through email, and that the NTN program helped them to learn how to communicate through that medium as a professional. Graduates 11
and 12 spoke specifically about how much feedback they received from their Language Arts teacher in the NTN program, and how it helped them improve as a writer during their time in the program. Graduate 11 said, “She just taught me how to write in a way that was both reflecting who I am, but also still being, you know, professional.”

Responses were more in agreement about the impact the NTN program had on graduate’s oral communication abilities. Four graduates recalled how the focus on oral communication in the NTN program helped them to “get out of their shell” during their time in high school. Graduate 9 mentioned that they entered the NTN academy as an “anxious individual” who was “too scared to even call a restaurant to place an order for pickup.” Graduate 2 mentioned that they learned how to “open up” and become more social. Graduate 1 stated that they were not a very “verbal communication person” and that “expressing an idea verbally” was an area they were not strong in at first, but got better at it over their time in the program. Graduate 3 recalled having to speak in their graduation ceremony, which was something they never imagined they would have agreed to do prior to entering the NTN academy.

Graduates focused on the frequent practice of presentations that contributed the most in their growth in oral communication. Graduate 6 stated that having to do presentations as a part of every project helped them build confidence in presenting, especially since they have to put together presentations frequently for clients in their current career. Graduate 8 also credited presentations in the NTN academy for helping them build their confidence and skills in public speaking. They stated in their current career they “definitely speak more than they write” because they must promote their business. Graduate 12 brought up the fact that they had to present frequently to guests who were brought in from outside the school, and how that helped them to build more confidence in themselves in order to present information to them.

Finally, participants also connected oral communication with collaboration, and spoke how they learned through the PBL process in the NTN academy how to be better communicators with their colleagues. Graduate 7 stated that they learned that communication was important to success as a group because, “if you’re not communicating effectively with your team pretty much at all times, your end product is not [going to] be great.” Graduate 1 recalled that the NTN program helped them to be more willing to speak up and share ideas, especially if they saw that there was a potential problem in the project. Graduate 5 mentioned how they would share feedback with each other about a project presentation, and how that communication helped them
to fix a problem with their presentation. Graduate 9 pointed out that they learned to communicate with more than just their classmates; they also learned how to communicate more with their teachers and members of the community through their time in the NTN program because each project required students to reach out and make connections with outside community resources.

Table 11

Frequency of Responses According to Common Themes of Interview Question 4

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<th>Theme</th>
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<tbody>
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<tr>
<td>NTN helped grow writing ability</td>
<td>6</td>
</tr>
<tr>
<td>Growth in oral communication and overcoming shyness</td>
<td>4</td>
</tr>
<tr>
<td>Frequent presentations and oral communication growth</td>
<td>3</td>
</tr>
<tr>
<td>Oral communication and collaborative process</td>
<td>3</td>
</tr>
</tbody>
</table>

Interview Question 5: How comfortable are you in interacting and working with someone who is of a different background than you? How comfortable are you with seeking out opinions and thoughts from multiple perspectives?

Interview participants were asked to describe if the NTN program had any influence on their comfort in working with individuals from different backgrounds, and if the program had any influence on their comfort level in seeking out opinions and thoughts from multiple perspectives. Respondents indicated that they were very comfortable working with someone from a different background from their own and credited the NTN program for helping to build that level of comfort. They also spoke positively about their ability and desire to seek out opinions from multiple perspectives and use those ideas to better their own understanding of the task they were working on.

The primary feature of the NTN program that interview participants attributed to their comfort in working with people of diverse backgrounds was the collaborative grouping. It was the process that teachers used to create groups that graduates pointed to that helped them become more comfortable with diversity. Graduate 9 recalled how teachers in the program would assign
groups by “random selection” rather than allowing students to choose who they worked with. Graduate 3 remembered frequently being partnered with classmates who they felt were at a different academic level than themselves, and when they started the program there were students they initially did not want to be partnered up with because they were not “historically” good students. However, they learned through working with them that, “everyone has something to give.” Graduate 11 recalled feeling nervous when first getting put in a group with students and interacting with them because they did not know what they were comfortable with. During their time in the program they learned to grow out of the uncomfortable feelings when they realized that their worst fears of people’s reactions did not happen.

Graduates pointed out that the student population of the NTN academy had a lot of diversity in their opinions, which helped them become comfortable working with individuals from different backgrounds. However, graduates did not define diversity in the NTN academy solely in terms of racial or ethnic diversity, they also defined diversity in terms of personalities and academic abilities as well. Graduate 10 focused on the diversity in personalities by saying that they felt that every student in the program was different and communicated with each other differently. Graduate 12 said that while they were a social person, others were not, so they needed to help them in the group process to work through their shyness. Graduate 1 identified themselves as a different personality within the program, and that they used that difference to help build consensus within the collaborative group projects:

I tried to be the funny guy for most of my time there, and so I think it helped me in finding that one little thing that relate to them, and that drove our conversations, it drove our collaboration, it drove everything. Even if it meant that I was working with somebody I didn’t necessarily like, we had at least one thing in common.

Graduate 6 focused on diversity in terms of “opinions” by saying that the NTN academy helped them to, “accept what other people wanted to say or look at from a different perspective, and not just be stuck in my own perspective.”

Graduates spoke about how working with diverse people was an important skill they have had to use frequently since high school. Graduate 2, 3, and 7 talked about their experiences with diversity in college, and how they felt the NTN program helped them be more open and comfortable with the diverse student populations they experienced. Graduate 7 said that while they felt the student body of the NTN program was diverse, they felt the college they attended
was more diverse. However, they felt completely at ease with it because they felt that after experiencing the NTN program, they “had a better understanding of people” and knew how “to effectively collaborate with people of different backgrounds.” Graduate 3 echoed the same sentiment, saying they felt there was more diversity in the student body in college, but being able to work with a diverse set of students in high school helped them in college because were ready to work with anybody.

Three participants also saw the benefit of working with diverse individuals in the career settings as well. Graduate 5 and 9 stated that they had to work with a very diverse population of individuals in the healthcare settings they work in and attributed their ability to work with the different patients that they encounter to their experience in the NTN program. Graduate 6 compared the compromising they learned to do with their group members in the NTN academy to how they have to work with customers in their current career. They stated that all their clients are different and want different things, so they see how they have to continue to learn how to compromise with the different needs of their customers.

The common theme that NTN graduates spoke about most frequently was how comfortable they became with receiving feedback and opinions from multiple sources. Graduate 8 summed up the common sentiment that many felt when they said that they “love constructive criticism.” Graduate 6 recalled that by their senior year, they had become very comfortable with seeking out other opinions and would willingly ask other people to critique their work. They said they realized that this critique would make their project or presentation better, which is a value they still carry with them in their career. Graduate 5 also pointed out that they also learned to value feedback and input in their career, seeking out their older co-workers to learn from their experience. Graduate 12 said they loved to be “critiqued” and learned through the NTN program that constructive criticism only made them better. Graduate 11 said that before they entered the NTN program as a 9th grade student, they found feedback they received from teachers as “offensive” because there was little explanation, so they felt that the comments were “knit picky”. However, they felt they experienced a different type of feedback from their NTN teachers: “Usually when we got a grade in the NTN academy, we were able to sit down and talk about it like the teachers were amazing for us to do that…”
Table 12

Frequency of Responses According to Common Themes of Interview Question 5

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<tr>
<td>Comfort with diverse opinions/perspectives</td>
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</tr>
<tr>
<td>Working with diverse backgrounds in college and career settings</td>
<td>7</td>
</tr>
<tr>
<td>Receiving and seeking feedback</td>
<td>5</td>
</tr>
</tbody>
</table>

Interview Question 6: *In the career or college setting you have worked in since high school, how much have you had to use the skills of collaboration, communication, and problem solving?*

Graduates were asked to determine how frequently they must use the 21st century skills that were a focal point of the NTN program in their current lives. Each participant indicated that they felt they were required to use each skill in some shape or fashion in either the college or career settings they were currently in. Participants were able to recall specific examples of how they utilize many of the skills on a daily basis. Their responses also indicated that they felt confident in practicing these skills based on their time in the NTN program.

One of the skills that graduates would mention they use the most was communication. Almost every graduate indicated they felt they had to use effective communication in some form every day in their current college or career environment. Graduates 5 and 9 noted that as nurses they have to communicate effectively every day with patients and physicians during their jobs. Graduate 9 pointed out that just communicating with their patients was not enough; it was important to communicate in a way that they are able to easily understand the diagnosis. Graduate 1 brought up their work in an elementary school, and how they have to constantly communicate with the other teachers that they are working with, so they are able to effectively plan the reading instruction they are providing students. Graduate 6 felt that NTN helped them refine their communication abilities with their clients to make sure they are providing them the design they want for their space. Graduates 2 and 3 mentioned how frequently they had to present in their college classes, and how the practice they had in the NTN program gave them more confidence to do it in their college classes. Graduate 12 remembered having to take a
speech class in college, and how their experience in the NTN program made giving speeches in front of their class easier.

Collaboration was another skill participants referenced frequently that they use in their daily lives. Graduate 8 talked about being an entrepreneur and working in a salon with other entrepreneurs. They have discovered that they cannot grow their own business without networking and collaborating with other people. Graduate 6 spoke about having to collaborate with other designers to critique their ideas to make them better. Graduate 9 provided the example of working in a hospital setting, and having to collaborate with other people to determine prognoses or referring patients to the right department. Graduate 3 spoke about being surprised at the amount of group projects and collaboration opportunities they had in college. They thought prior to attending that most classes would follow the pattern of, “the classic sit in front of a lecture, and hear the lecture, do the exam,” style. They were pleasantly surprised that this was not their full experience in college, and was glad that they had the experience of NTN to help them feel “ready” for college. Graduate 11 also expressed surprise about how much they were required to collaborate in the nursing program they attended: “I didn’t even expect for nursing school to be as collaborative as it was. Like, I expected it in clinical, but even in class they had us in groups a lot.”

Other skills that were researched in this study were not mentioned as frequently by participants, but some graduates did mention them as having to use them in their lives after graduation. Graduate 4 spoke about having to use problem solving frequently after high school when they enlisted in the military. However, they mentioned that problem solving in the military was different than what they experienced in the NTN academy because military problem solving involved more of taking orders from superior officers. They mentioned that getting to problem solve in the NTN academy was “easier and more fun.” They also said it took them a while to break out of the mode of simply following orders after they left the service and enrolled in college. They felt that if they had gone straight from the NTN academy to college, they would have been more successful in college starting off.

Graduate 1 attributed agency, or self-reliance, as the one skill they learned in NTN that they use the most in their post-secondary life. They said, “agency I think is the biggest one that I use because even when I didn’t want to get up and go to class, or I didn’t want to write something, do something, work on something here at the school, agency was there to say, ‘take
responsibility’.” Graduate 1 credited the NTN program for helping them learn how to be responsible for their work, and make sure that they have left each day and accomplished their goal for the day. Graduate 9 also credited the NTN program for their “work ethic, responsibility, and integrity.”

Table 13

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<th>Theme</th>
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<tbody>
<tr>
<td>Communication</td>
<td>7</td>
</tr>
<tr>
<td>Collaboration</td>
<td>5</td>
</tr>
<tr>
<td>Problem solving</td>
<td>1</td>
</tr>
<tr>
<td>Self-Reliance</td>
<td>2</td>
</tr>
</tbody>
</table>

Interview Question 7: What is your overall impression of the impact that the NTN program has had on your post-secondary life?

Graduates who participated in the interview were asked to assess their perception of the overall impact that their participation in the program has had on their life since high school. NTN graduates who participated felt that their experience in the program had an overall positive impact on their lives after high school. Five participants pointed out that they did not always think this would be true, especially when they were in high school and actively going through the program. Graduate 9 remembered thinking that the overall academy was a “dystopia” while in school and not being sure if it was making an impact on their future; Graduate 10 mentioned that they knew a lot of people who did not like the program and maybe had “second thoughts”. Graduate 6 stated that at times when they were a student they would say to themselves, “I don’t like this; this is hard.” Graduate 3 admitted that when they were in the program, they had reservations about it because they felt they were a “classic” learner who did best when they would pay attention in class, take notes, complete their homework, and take the test. Graduate 1 recalled feeling “skeptical” about the effectiveness of the program, especially as a 9th and 10th grade student. However, all these graduates stated that eventually they saw the benefits of the NTN program through what they experienced in their lives after high school.
For those NTN graduates who attended college after high school, they felt their participation in the program gave them the preparation they needed to be successful in their coursework. Graduate 7 felt that the NTN program was, “as close as you can get to a college experience without going to college I would say.” Graduate 8 made a similar comparison, saying that most of what they did in the NTN academy they did in college as well, but that they felt comfortable in college because they felt that it was not their first time doing these tasks they were assigned. Graduate 10 said that the NTN program prepared them for college because they felt, “we were getting more work than regular classes.” Graduate 2 said, “If I had done something different like just gone to normal classes, I don’t think I would have been as prepared for social situations, group work, collaboration presentations as I am now.”

Finally, several graduates credited the NTN program with affecting positive change in them as a person. Graduate 1 described themselves before high school as a kid who was “angry, different, (and) didn’t want to accept what was going on at the time.” They said the NTN program “met (them) in the middle” and with the different way of learning changed how they thought about things in a positive way. Graduate 2 and 3 gave credit to the NTN program for breaking them of their shyness, and making them a more social person. Graduate 11 said that the overall freedom that they gave us ended up being beneficial and teaching me like you know nobody’s [going to] hound you on time not now, and not in adulthood. So, you’ve got to manage your time effectively and get your tasks done.”

Graduate 6 and 10 said that the NTN program gave them more confidence, which they both said helps them to perform in their current careers. Graduate 9 believed the NTN academy “shaped me into the strong, independent woman that I am today.”

Table 14

<table>
<thead>
<tr>
<th>Frequency of Responses According to Common Themes of Interview Question 7</th>
<th>n</th>
</tr>
</thead>
<tbody>
<tr>
<td>Change in their perception of NTN while in the program</td>
<td>5</td>
</tr>
<tr>
<td>Prepared them for college</td>
<td>4</td>
</tr>
<tr>
<td>Created growth in them as a person</td>
<td>7</td>
</tr>
</tbody>
</table>
Themes

Based on the data collected through the survey and interviews, several emergent themes developed with the research questions. For the first research question, the following themes developed through the participant’s responses:

- The NTN program had a strong impact on building the graduate’s capacity for personal responsibility and leadership.
- The NTN program helped individuals grow and see the benefits of collaboration while in high school.
- Graduates felt they grew more in oral communication compared to written communication.
- Graduates felt they became more comfortable with diverse thought and grew to value critical feedback through their experience in the NTN program.

For the second research question that examined how often they felt they used the 21st century skills they were emphasized in the NTN program in their post-secondary lives, the following themes immerged in the data:

- While graduates felt their experience in the program influenced their ability to successfully navigate through the college or career path they took, it did not influence them to go in the specific path they took.
- Graduates felt that they are required to use the 21st century skills they learned every day in their post-secondary lives.

Summary of Data

Graduate responses in the survey and interviews indicated that they perceived some growth in 21st century learning skills due to their participation in the NTN program. Graduates felt that the NTN program contributed the most in building their capacity to communicate orally, collaborate with individuals, build their personal responsibility, and their capacity to seek feedback to improve their work. The data from survey responses and interviews also indicated that the NTN graduates who participated in the study also felt that they used the skills they developed during their time in high school daily. This experience was the same for NTN graduates regardless of the post-secondary pathway they took; graduates who attended college reported using the 21st century skills emphasized in the NTN program as much as those who
went into the workforce at some point after high school. According to the data provided by the graduates, the 21st century skills they developed during their time in the NTN program contributed to their successful transition into both college and career pathways.
CHAPTER 5
FINDINGS AND CONCLUSIONS

Purpose of the Study

The purpose of this research study was to determine whether a project-based learning (PBL) academy utilizing the New Tech Network (NTN) model positively shaped the acquisition of 21st century learning skills based on the perceptions of graduates from the academy. This study addressed limited research on the impacts of PBL instruction and the NTN model on students once they have left school. The main objective was to determine, through the perspective of students who have graduated from a NTN academy, whether PBL instruction through the academy had a positive impact on students developing the specific 21st century skills of critical thinking, oral communication, written communication, collaboration, self-reflection, and self-reliance. Additionally, this study determined if NTN graduates feel that they have successfully used these 21st century skills in their lives after high school.

This study was a phenomenological case study of an academy located within a high school in Virginia that implemented the instructional practice of PBL through the NTN model and its impact on building 21st century learning skills in the students that voluntarily went through the program. The study population were students who attended the NTN academy, graduated from the program, and entered post-secondary educational programs or career fields. By researching the perspectives of students who have participated in the program and are now in a post-secondary education setting or workforce, the long-term influence of PBL instruction on developing 21st century learning skills can be determined.

Research Questions

This study of graduates of a New Tech Network program was guided by the following research questions:

1. What was the perceived impact of the New Tech Network model of Project-Based Learning on the development of 21st century learning skills while in high school?
2. What was their perception of how they have utilized the 21st century skills taught in the New Tech Network model in their lives since leaving high school?
Summary of Findings

Based on the survey and interview data discussed in Chapter 4, this case study found that the NTN program had a positive impact in building the 21st century skills development of graduates who participated in the program. The data showed that graduates who participated in the program not only felt that they used these 21st century skills every day in their post-secondary lives, but also feel that they use them successfully. The following is a detailed discussion of each finding, how the findings connect with existing research, and implications of this research for educational practitioners.

Discussion of Findings

Finding #1: The NTN program had a positive impact on building the graduate’s capacity for self-reliance.

Graduates participating in the study indicated that one of the areas where they felt they had the most advanced development in 21st century skills was in the skill of self-reliance. As shown in Table 5, 60% of the NTN graduates indicated that they believed their ability in self-reliance was “advanced” at the end of their time in the NTN program. Additionally, interview responses from interview question #2 showed that they felt that specific elements of the PBL process that were embedded in the NTN philosophy contributed to their growth in self-reliance. Graduates talked about how during their time in the program, each group project required every member to play a specific role in the group. In the group projects they were assigned in the NTN program, graduates recalled each group member being assigned some type of specific task by other members of the group, not the teachers. Interview participants frequently stated the desire while they were in high school to “pull their own weight”, meaning that they did not want to be seen as someone who was holding the rest of the group back. They felt that they learned through the process to be accountable to each other, the group, and ultimately the group’s success in the final product they were creating. One of the roles that graduates of the NTN program frequently mentioned in the PBL process was that of project leader. Several interview participants talked about how they felt their experience in the NTN program helped to build their capacity to lead others. They pointed out that they learned how to leverage the strengths and weaknesses of everyone in the group and learned how to assign specific tasks that would not just make individual group members successful, but the entire group successful as well.
These findings connected back to findings found in previous research on PBL and NTN schools. The terms “self-reliance” and “agency” are used interchangeably in the research literature on PBL. According to the NTN (2020), they use the term agency in their model and define it as the student’s ability to take ownership of their learning. One of the primary features of PBL instruction found in the research literature was the capacity for students to build ownership over their learning through the project process, and build their skills in personal agency (Barron et al., 1998; Tienken, 2020). Research also indicated that the use of projects in the classroom helped to build growth in 21st century skills like self-reliance (Bell, 2010; Mosier et al., 2016; Moylan, 2008). Graduates indicating that they felt they grew in their capacity to be self-reliant and build their leadership ability supports this finding that their experience built their skills in this area. Culclasure et al.’s (2019) research concluded that students who participated in NTN programs exhibited higher social and emotional skills compared to other students. Graduate responses indicated strong inter-personal abilities by being able to identify and work with the different abilities of everyone within their project groups.

Finding #2: The NTN program helped individuals grow and see the benefits of collaboration while in high school.

Collaboration was a 21st century skill that participants felt they were the weakest in upon entering high school. As shown in Table 4 in Chapter 4, 25% of respondents indicated that their collaboration skills were “undeveloped”, while only 5% indicated they were “advanced”. In the interview data for Interview Question #3, graduates frequently described how much they did not like working with other people in schools and how they preferred to stay to themselves when they first entered the program. Once they entered the NTN program, graduates described a shift in how they perceived group work. The constant collaborative atmosphere of the NTN program forced them to work with others not just in their class, but also in the community as well. They also learned that collaboration could be a powerful skill to help build a better product. Several graduates talked about how they learned that by working together, they could accomplish more than they could if they just simply worked on a project on their own. They learned to appreciate the fact that they were not the only ones with good ideas; other students could also have good ideas that can make a project even better. Survey data in Table 5 showed that at the end of the program, 50% of the participants in the study felt that they were “advanced” in their collaboration abilities.
Research on PBL in practice has identified the instructional practice as an effective means to support student growth in collaboration (Bell, 2010; Mosier et al., 2016; Moylan, 2008). Therefore, research has shown that student growth in collaborative abilities is a positive byproduct of the practice when teachers use collaborative groupings paired with PBL instruction. The NTN model of PBL instruction these former students participated in chose to incorporate a collaborative culture. As the research participants indicated, almost every instructional project they participated in involved collaborative groups. Research by Ravitz (2010) showed that the NTN program had a positive effect on improving student culture, which supported the data provided by interview participants of strong working relationships they developed during their time together in the program. Moiser et al.’s (2016) research on NTN programs found that the NTN model had a positive effect on building collaboration between the school and community through collaborative partnerships. Interview responses further supports this conclusion of the NTN model and collaborative experience, with NTN graduates in this study highlighting how they were able to build their collaborative skills through partnerships in the communities they were situated in.

Finding #3: NTN graduates felt they grew more in oral communication over written communication

Of all the 21st century skills that participants were asked to rank their abilities in before entering high school and the NTN program, written communication was the skill that received the highest scores. The survey data in Table 4 shows 30 percent of respondents giving themselves a score of 4 out of 5 on written communication ability, and 20 percent giving themselves a score of 5 indicating they believed there were at an advanced level. Conversely, participants viewed their abilities in spoken communication as very undeveloped. Survey responses shown in Table 4 show 40 percent of respondents assigning themselves a rank of 2 out of 5 in their oral communication abilities, and 20 percent responding they were undeveloped in this area by giving themselves a score of 1 out of 5. Interview responses for Interview Question #4 explained why there was a difference in how NTN participants viewed their ability prior to high school in these two areas of communication. Graduates mentioned in interviews they had received prior instruction and practice in writing in elementary and middle school, but their exposure to deliberate activities that helped them build their oral communication skills were limited.
After completion of the NTN program, survey responses showed that the graduates who participated felt their abilities in these two means of communication were more advanced. Survey results contained in Table 5 showed that 60 percent of the participants felt their written communication abilities were advanced after completing the NTN program, and 45 percent believed their oral communication abilities were advanced after completion. Interview responses in Interview Question 4 indicated that graduates attributed the consistent practice they received in both of these skills that contributed to their growth in these areas. In oral communication, graduates mentioned that they frequently had to put together and perform presentations not just in front of their classes, but sometimes to audiences of individuals from outside the classroom. By having to perform presentations frequently throughout the course of their time in the NTN program, the program participants were able to overcome the initial fear they had in presenting to a group of people. According to their interview statements, they went from fear and avoidance of public speaking to feeling comfortable in communicating with anyone they needed to communicate an idea to. Interview participant data showed that graduates cited communication as one of the skills they used the most in their post-secondary lives. They also connected oral communication to effective collaboration. Graduates cited they learned that in order to effectively collaborate with their peers in project groups, they had to learn how to communicate effectively in their spoken communication with each other.

In written communication, several graduates mentioned how written components were a frequent part of each project they were assigned in their NTN classes. The frequent practice of writing combined with the specific feedback they received from their English/Language Arts instructors helped them to grow in their abilities to communicate through written means. However, some interview participants did feel that the writing they were required to complete in the projects in their NTN courses did not reflect the same type of writing they had to do in their college courses. Several graduates mentioned “professional” in conjunction with written communication, and felt that they learned how to communicate more effectively through written form more as a professional rather than through more academic formats.

These findings support previous research on PBL instruction, the NTN program, and their effect on student communication. Several studies done on both PBL as an instructional practice and the NTN model have shown that specific core subject areas are more naturally aligned with PBL practices than others, with subjects like social sciences and English/Language Arts showing
more student success using PBL than other core subject areas (Chen & Yang, 2017; Craig & Marshall, 2019; Summers & Dickinson, 2012; Virtue & Hinnant-Crawford, 2019). Since communication skills are traditionally taught in English/Language Arts courses, the consistent presence and support participants received each year they were in the program contributed to their growth in these skills. Previous research has also found that PBL instruction and the NTN model has a positive effect on supporting student growth in written and oral communication (Bell, 2010; Mosier et al., 2016). Data from the interview participants continued to support this finding, with graduates indicating throughout that the PBL process they experienced while in the NTN program frequently involved written and oral communication, which helped them to grow in those skills.

*Finding #4: Graduates felt they became more comfortable with diverse thought and backgrounds and valued critical feedback.*

Working with individuals with diverse backgrounds and ideas is an essential part of the skill of collaboration. In the interview data contained in Interview Question #5, graduates felt that the students who were a part of the NTN program were diverse, but the one area of diversity they frequently came back to was how they were diverse in terms of their talents and abilities. They recalled that project groups were generally assigned by the teachers through some type of random selection, which meant that they frequently were put in situations where they had to work in heterogenous ability groups together. There was a sense that this created a challenge for students at first having to navigate the different abilities and personalities of students. Other participants described difficulty at first listening to different perspectives about the project, especially if the perspective or idea was different than their own. However, as they progressed through the program, their views begin to change on working with diverse individuals and came to appreciate how it would deepen their knowledge of a topic. They learned that while individuals might have different academic abilities and talents, each person had the capacity to contribute something to the final project that would make it successful. Graduates spoke about how they were able to learn where their classmate’s individual strengths and weaknesses were over time and learned how to assign people tasks that took these factors into consideration so that the group could be more successful.

Graduates spoke highly of receiving feedback both from their peers, but also from their teachers in the program as well. Their responses in Interview Question #5 followed a similar
pattern where they learned that the purpose of feedback was to improve their performance, and not as an attack on them as an individual. Through the feedback, they learned why they received points off on a task or project, or what went wrong, which they felt helped them get better as a student. This was evident when several participants stated that they “loved” to receive feedback. Instead of passively receiving feedback, responses indicated that by the time they graduated they actively sought out feedback from both their classmates and teachers.

Research on PBL supports these findings about the growth in graduates’ capacity to embrace diverse thought. Tienken (2020) states that PBL allows for students to grow in their capacity for civic growth and social justice, which the acceptance of diversity that NTN graduates described fits within those parameters. Culclasure et al. (2019) study on three different NTN affiliated schools also showed that students within that program showed more social awareness and relationship skills compared to their peers. Research also supports the finding that students became more comfortable with feedback as a means of improving their work over their time in the NTN program. Barron et al. (1998) identified student reflection and revision of their work as a key feature of PBL instruction, as well as student ownership over their learning. Several studies on PBL highlight how the instructional practice is student driven, which leads to building student ownership of the learning process (Colley, 2008; Tienken, 2020; Thomas, 2000). Data found in this study showed that students in this NTN academy were able to take ownership over the academic diversity of their groups and use that to help make them as successful as they could be. Finally, research on 21st century skills shows a link between PBL instruction and the building of self-reflection skills in students (Bell, 2010; Mosier et al., 2016; Moylan, 2008). Graduates studied in this case study showed a willingness to reflect on their work, and seek out other opinions as well.

Finding #5: The NTN program had a limited impact on the pathways graduates took after high school.

The graduates who participated in the study attributed the skills they learned in the NTN program for helping them succeed in the post-secondary education paths they took and in their early careers, but largely did not feel the program influenced the decisions they made to go to college as shown Table 8. Those participants who did enroll in college at some point after graduation from high school mentioned specifically how much the skill of collaboration was used in schools they attended, and in some cases expressed surprise at how much they did have...
to collaborate. As one graduate mentioned, they were under the assumption that most college classes would utilize more of a lecture format. The comfort they built in the NTN program with collaboration helped make them feel successful when having to work with collaborative groups in college.

Regarding career choices, only one graduate could point to any specific influence a specific project had on pointing them in the direction they went. However, there were some graduates who mentioned that some part of their experience in the NTN program influenced their career pathway as shown in the responses Table 8. Where they felt the NTN had an influence was in giving them the confidence in the specific skills they learned. If a graduate felt that through their experience they enjoyed collaborating with others, they mentioned that they looked towards careers that would allow for that. If they enjoyed and felt they had a talent with communication, they found a career that would emphasize that skill.

Previous research on the NTN model and PBL instructional practices used in NTN academies indicated a strong positive connection between PBL and influencing college and career pathways. Research on defining effective PBL practices stated the goal of project design should be to mimic real-world situations and problems, thus giving students exposure to different careers and the types of tasks they might face (Blumenfeld et al., 1991; Moylan, 2008; Tienken, 2020; Thomas, 2000). Moylan (2008) stated that PBL allows for students to “personalize” their learning by using their own interests to explore different topics within a project. Mosier et al.’s (2016) study on PBL in NTN programs found that students gained inspiration to explore different careers because of the different real-world roles they took on in projects while in school. Based on the responses of the participants in this NTN program, graduates felt more inspired to explore careers not based on roles they took in a project, but more on the interest they took in specific skills they learned and developed while they were in the program.

The results gathered in this case study therefore does not align with prior research on NTN programs and PBL instruction. Student responses in the interviews did not lend any specific reasons why they felt that their NTN program did not inspire them to pursue the career’s they eventually went into. For those graduates who did specify why they chose to go into the career that they did, they usually stated it was something they wanted to do before entering high school and the NTN program.
Finding #6: NTN graduates feel that they use the 21st century skills they successfully learned every day in their post-secondary lives.

In the survey responses shown in Table 6, all of the participants responded affirmatively that they felt they have used each of the 21st century skills at least once since graduating high school. Most of the responses indicated that they used each of the skills daily. The skill that received the fewest daily responses was self-reflection with only 60 percent of graduates indicating they use it daily. Critical thinking and oral communication were the two most frequently used skills according to the survey, with 90 percent indicating they use critical thinking daily and 95 percent stating they use oral communication daily. When asked how successfully they felt they used each of the 21st century skills in their post-secondary lives, a majority of participants felt they were successful in using the skills with a range of 55 and 65 percent responding they were successful in using each of skills in the survey responses shown in Table 7. While the survey responses indicated that critical thinking was one of the skills graduates felt they used the most in their daily lives, interview participants seldom mentioned critical thinking when talking about the skills they felt they used the most. The majority of graduates talked about examples of how they have to collaborate with others in their schools or jobs, and the daily requirement of communication with other individuals. However, when looking at the specific collaborative and communicative examples the graduates provided, many of them had critical thinking and problem solving embedded in them. For example, one graduate referenced having to communicate with the classroom teachers they worked with in order to plan for the reading instruction they needed to provide for a student. Even though they focused more on communication, this example also involved problem solving in they were trying to support a student’s deficiency in reading and develop a plan to address it.

These findings support the current research literature on 21st century skills and their necessity for current and future students. Research indicates that while the skills that are defined as “21st century” are not new or unique to this century, the need for students to successfully develop these skills is taking greater importance in the 21st century (Rotherham & Willingham, 2010; Silva, 2009; Wagner, 2008). Research has also indicated that proficiency in the skills of oral and written communication, collaboration, and problem solving are frequently found in modern job advertisements, especially in jobs that require higher education requirements (Rios et al., 2020). This research further supports this conclusion that these skills are being required of
individuals in modern work environments through the frequency of responses indicated by study participants. Therefore, the need for more intentional instructional support in building these skills in students is highly important.

**Implications for Practice**

Based on the findings of this study, the following are implications of this research for educational practitioners:

- The NTN program can be utilized by schools to provide successful instruction and development in 21st century skills.
- The NTN program can be utilized in schools that have a need for promoting greater college and career preparedness.

The following is a detailed discussion of each of the implications for this study.

*Implication for Practice 1: The NTN program can be utilized by schools to provide successful instruction and development in 21st century skills.*

Findings 1, 2, 3, and 4 as discussed previously show that the NTN program and the use of PBL instructional practices are effective in providing growth in 21st century skills in the students who participate in the model. Graduates who participated in this program not only indicated that they felt that they grew in the skill areas studied, but also retained these abilities in their post-secondary lives as discussed in Finding 5. With greater attention and focus on 21st century skills development in K-12 schools, the NTN model is an effective means of providing instruction in these skills for students. The total immersion in skills development that graduates talked about made them feel that they were able to grow and become more successful in these skills. Educational practitioners who want to improve on 21st century skills instruction should keep this characteristic in mind when trying to improve outcomes in their settings. By imbedding 21st century skills development into each class and the curriculum of the NTN academy, students received constant and consistent practice and support in these skills during their four years of high school. This total immersion of skills and curriculum may be more effective than simply trying to teach individual skills separately or sporadically throughout a student’s academic career.

*Implication for Practice 2: The NTN program can be utilized in schools that have a need for promoting greater college and career preparedness.*
Not only has greater attention been placed on 21st century skills development, but educational policy has also emphasized college and career readiness in recent years. For example, as discussed in Chapter 1, in Virginia the implementation of the 5C’s and Profile of a Graduate has put a greater emphasis on making sure students are graduating ready to be successful in both post-secondary education and in careers. As discussed in the findings, the NTN program has a positive effect on providing students the skills necessary for a successful transition into both college and careers. Graduates interviewed frequently talked about how the constant use of collaboration, written tasks, and oral presentations during their time in the NTN academy prepared them for what they experienced when they enrolled and took classes at the college level. Also, they spoke of how the culture of the program that emphasized personal responsibility and ownership of their learning carried with them to college to help them succeed. In their opinion, they felt prepared for the expectations and responsibility of taking college courses, and attributed it to their experience in the NTN program. Those participants who have started careers also expressed a feeling of preparation for the skills they needed to have to be successful in their job. For educational leaders and practitioners, the evidence and findings support using the NTN model for college and career preparation.

However, the findings of this study make it important not to conflate career preparation with career exploration, since the graduates in this study did not feel that their experience in the NTN program directly influenced the careers they chose to go into. While previous research on PBL and the NTN model indicated they both gave students career exploration opportunities, the responses by the participants of this study did not support prior research. This finding may imply that educational leaders should look to other programs if their goal is to help students explore career interests.

**Suggestions for Future Research**

While this study focused on 21st century skills development, academic achievement of students is still a major mission of public education. While there have been some comparison studies between NTN and non-NTN affiliated schools on academic achievement scores in other states, further research can be applied to NTN and non-NTN affiliated schools in Virginia to compare Standards of Learning (SOL) assessment data to determine if there is a significant difference in academic achievement on SOL assessments. Since this was a case study of one
NTN program and its graduates, further research could be applied to other NTN affiliated programs to see if the findings in this study are unique to this program or found in other NTN programs as well. Additionally, while the NTN model uses PBL instruction as its primary pedagogical approach in delivering instruction to students, PBL is not exclusive to NTN schools. The findings in this study were not clear if the gains students perceived in their 21st century skills were due to the NTN model, PBL instruction, or a combination of both. PBL is practiced in many educational settings outside of NTN affiliated schools using similar curricular practices.

Further research on schools that utilize PBL as their primary means of teaching curriculum, but are not affiliated with the NTN model, could determine if the gains in 21st century skills development are a product of just the NTN model, or attributed more to PBL as an instructional practice. Finally, this study focused on 21st century skills development in an NTN affiliated high school. The NTN model is used not just in high schools, but in middle and elementary schools as well. Further research on how the NTN model impacts 21st century skills development in middle and elementary school students would be necessary to see if students at younger levels show the same results.

Summary

This case study of NTN graduates found that the graduates perceived that their participation in the academy created growth in their ability to communicate effectively, collaborate with others, problem solve, and take responsibility over a problem. They indicated that since graduation from high school, they are able to successfully use these skills in their lives on a daily basis, and attribute their experience in the NTN academy for that success. For educational practitioners wanting to provide or improve 21st century skills instruction in their secondary schools, the findings of this study suggest that the NTN model is an effective means to provide instruction in these skills that will have a long-term impact on students.

Personal Reflections

Going into this case study, I knew that the trying to use the study population I wanted to use would present serious challenges. Trying to track down graduates who were in some cases four years removed from high school was going to be difficult because of the lack of accurate contact information for those graduates. Additionally, the further removed in time from high
school a graduate becomes, the less engaged they are with that school. My experience in this study was no different than my initial fears. While the school division where the NTN academy was located was extremely helpful in providing a list of names, they did not have any reliable contact information to share that would help me contact potential participants. This problem is more than likely true for every school division in the United States. Fortunately, with social media being as ubiquitous as it is today, it did serve as a useful tool in reaching out to contact as many potential participants as I could. However, the response rate from those that were contacted was very low, which was extremely disappointing.

However, those who did participate made the study worth it. It is extremely rare in education where practitioners can connect with graduates and see what the impact of their work on those students was once they have moved into their post-secondary lives. Most of the success data schools collect are on students currently enrolled, but they lose track of students once they graduate and therefore do not have a chance to determine the impact of their work on student success after graduation. The mission of all schools is to provide students with the knowledge and skills they need to live a productive life as an adult, but schools frequently do not measure success in former students. This was why I wanted to do something different with this study by focusing on graduates of a program as opposed to current students. It was extremely satisfying to be able to talk with graduates about how their educational experience in high school impacted their adult lives today. I found it extremely enlightening as a current practitioner to hear how lessons taught to individuals when they were in high school still resonate them in their current lives. Several participants indicated in their interviews how thankful they were to be able to participate and talk about something they believed had an impact on their current lives. Therefore, educational policy makers and leaders should seek to find more efficient ways to research former students and graduates in order to assess long term impacts of educational practices and policies on students. This may mean conducting exit surveys of graduating seniors in order to build a database of reliable contact information from students, and doing more to reach out and connecting with graduates once they have left high school to build that continued engagement with the school system.
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This is to certify that:

Joshua Bocock

Has completed the following CITI Program course:

Social & Behavioral Research (Curriculum Group)
Social & Behavioral Research (Course Learner Group)
1 - Basic Course (Stage)

Under requirements set by:

Virginia Polytechnic Institute & State University (Virginia Tech)

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APPENDIX B
IRB APPROVAL LETTER

Division of Scholarly Integrity and Research Compliance
Institutional Review Board
North End Center, Suite 4120 (MC 0497)
300 Turner Street NW
Blacksburg, Virginia 24061
540/231-3732
irb@vt.edu
http://www.research.vt.edu/sirc/hrpp

MEMORANDUM

DATE: January 4, 2022
TO: M. David Alexander, Joshua Daniel Bocock Bocock
FROM: Virginia Tech Institutional Review Board (FWA00000572)

PROTOCOL TITLE: Project-Based Learning and its Effects on 21st Century Learning Outcomes: A Phenomenological Case Study of Graduates from a Project-Based Learning Academy

IRB NUMBER: 21-1030

Effective January 4, 2022, the Virginia Tech Human Research Protection Program (HRPP) determined that this protocol meets the criteria for exemption from IRB review under 45 CFR 46.104(d) category (ies) 2(i),2(ii).

Ongoing IRB review and approval by this organization is not required. This determination applies only to the activities described in the IRB submission and does not apply should any changes be made. If changes are made and there are questions about whether these activities impact the exempt determination, please submit an amendment to the HRPP for a determination.

This exempt determination does not apply to any collaborating institution(s). The Virginia Tech HRPP and IRB cannot provide an exemption that overides the jurisdiction of a local IRB or other institutional mechanism for determining exemptions.

All investigators (listed above) are required to comply with the researcher requirements outlined at:
https://secure.research.vt.edu/external/irb/responsibilities.htm

(Please review responsibilities before beginning your research.)

PROTOCOL INFORMATION:

Determined As: Exempt, under 45 CFR 46.104(d) category(ies) 2(i),2(ii)
Protocol Determination Date: January 4, 2022

ASSOCIATED FUNDING:
The table on the following page indicates whether grant proposals are related to this protocol, and which of the listed proposals, if any, have been compared to this protocol, if required.
APPENDIX C
SURVEY INSTRUMENT

Part I: Demographic Information

1. Please select your college and/or career path after graduating from high school. Please select all that apply.
   a. Went into the workforce
   b. Enlisted in the military
   c. Trade school
   d. Associate degree program
   e. Bachelor’s degree program

2. What year did you graduate from high school?
   a. 2017
   b. 2018
   c. 2019
   d. 2020

Part II: Perceptions of NTN Program

For questions 3 and 4, please select your responses based on a scale of 1 to 5, with 1 representing “Undeveloped” and 5 representing “Advanced”.

3. Before starting high school, how would you rank your abilities in the following categories:
   a. Critical thinking and problem solving

   (Undeveloped) 1  2  3  4  5 (Advanced)
4. After completing the NTN program in high school, how would you rank your abilities in the following categories:

a. Critical thinking and problem solving
   (Undeveloped) 1  2  3  4  5 (Advanced)

b. Collaboration
   (Undeveloped) 1  2  3  4  5 (Advanced)

c. Written communication
   (Undeveloped) 1  2  3  4  5 (Advanced)

d. Oral communication
   (Undeveloped) 1  2  3  4  5 (Advanced)

e. Self-reflection
   (Undeveloped) 1  2  3  4  5 (Advanced)
f. Self-reliance

(Undeveloped) 1 2 3 4 5 (Advanced)

For question 5, please use the following scale to answer:

Never (1), At least once a month (2), At least once a week (3), At least once a day (4).

5. How often have you used the following skills in your life since graduating high school:

a. Problem solving

(1) Never
(2) At least once a month
(3) At least once a week
(4) At least once a day

b. Collaboration

(1) Never
(2) At least once a month
(3) At least once a week
(4) At least once a day

c. Written communication

(1) Never
(2) At least once a month
(3) At least once a week
(4) At least once a day

d. Oral communication

(1) Never
(2) At least once a month
(3) At least once a week
(4) At least once a day

e. Self-reflection
   (1) Never
   (2) At least once a month
   (3) At least once a week
   (4) At least once a day

f. Self-reliance
   (1) Never
   (2) At least once a month
   (3) At least once a week
   (4) At least once a day

For question 6, please select your responses on a scale of 1 to 5, with 1 representing “unsuccessfully” and 5 representing “Successfully”.

6. How successfully have you used each of the following skills since high school.

   a. Problem solving
      (Un成功) 1 2 3 4 5 (成功)

   b. Collaboration
      (Un成功) 1 2 3 4 5 (成功)

   c. Written communication
      (Un成功) 1 2 3 4 5 (成功)

   d. Oral communication
      (Un成功) 1 2 3 4 5 (成功)
e. Self-reflection

(Unsuccessfully) 1 2 3 4 5 (Successfully)

f. Self-reliance

(Unsuccessfully) 1 2 3 4 5 (Successfully)

7. Would you be willing to be considered for participation in a follow-up interview based on this topic?
APPENDIX D
INTERVIEW PROTOCOL

1. What impact did the NTN academy have on the decisions you made in pursuing the college and/or career opportunities you took after high school?

There is a connection between the relevance students find in their work in a PBL environment and pursuit of specific careers (Moiser et al., 2016).

2. What impact did the NTN academy have on how you handled a situation that required you to take ownership of the problem?

Part of the PBL model requires students to take ownership and agency over their learning and not be as reliant on the teacher (Barron et al., 1998).

3. What impact would you say your experience at the NTN academy has had on your collaboration abilities?

PBL has a positive effect on developing the 21st century learning skill of collaboration in students (Bell, 2010; Mosier et al., 2016; Moylan, 2008).

4. What impact would you say that your experience at the NTN academy has had on your communication abilities?

PBL has a positive effect on developing the 21st century learning skill of communication in students (Bell, 2010; Mosier et al., 2016; Moylan, 2008).

5. How comfortable are you in interacting and working with someone who is of a different background than you? How comfortable are you with seeking out opinions and thoughts from multiple perspectives?

PBL improves a student’s ability to understand those of different cultures and
backgrounds, and developing a sense of global cooperation (Moylan, 2008; Tienken, 2020).

6. In the career or college setting you have worked in since high school, how much have you had to use the skills of collaboration, communication, and problem solving? 21st century skills that are found in most demand by employers are the skills of collaboration, communication, and problem solving (Rios et al., 2020).

7. What is your overall impression of the impact that the NTN program has had on your post-secondary life?