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Project-Based Learning in an Alternative High School: A Survey of Students' Connection to School, Problem-Solving Skills, and College/Career Preparation

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Abstract

A Nation at Risk (1983) asserted that American schools were failing. Subsequently, considerable efforts have been made to address the need for more innovative instruction. In order for students to meet the demands of the 21st century, project-based learning (PBL) could be the solution. PBL is as an instructional approach to education that is designed to engage students in the investigation of real-world problems. The purpose of the study was to understand whether PBL positively impacts students' connection to their school, learning experiences, and preparation for college and career. This quantitative study included two groups of high school students. One group of students were immersed in a PBL program in their school, and the other group of students did not have a PBL program in their school. Every student in the two schools were exposed to the same curriculum throughout the duration of the research. This model made for a more logical comparison of the two schools. Students enrolled in the high schools were in Grades 9-11 and ranged in age from approximately 13 to 19-years old.

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Dedication

There are so many people who helped me obtain this triumph. It would not have been possible to complete this dissertation without their support and confirmation.

First and foremost, I am grateful to my family; my wife, Maureen, who has been by my side for over 10 years. To my daughters, Alanna and JoAnna, they inspire me every day to always do my best. My hope is that I have shown you how to be a good person. Thank you for believing in me. I hope that this accomplishment gives you all the courage to pursue wherever your dreams take you and serves as an example that ANYTHING is possible, and if it were easy, everyone would be doing it. Your support and love means more than I can put into words. Therefore, I dedicate this dissertation to my family; my lovely wife, Maureen, and my beautiful daughters, Alanna and JoAnna.

To my dissertation chair and coach, Dr. Kim VanDerLinden, I sincerely thank you for your incredible dedication, support, and guidance throughout this marathon. I have had many role models, coaches, and mentors throughout my lifetime, but I can honestly say that you are one of my best. Thank you for never letting me lose sight of the finish line. You truly have a genuine dedication to your students, and I am proud to be one of them. Without your encouragement, this dream would not have happened.

I would also like to thank my committee member, Dr. Dean Goewey, for all his time and support to mentor me and help me grow professionally. In addition, I would like to thank the faculty and staff of the St. John Fisher College Executive Leadership

doctoral program for the wonderful opportunities and contributions you provided for this accomplishment.

Biographical Sketch

Jody F. Manning is both the Chief Executive Officer of the seventh-largest BOCES and the New York State Commissioner of Education Representative to the 23 school districts in Onondaga, Cortland, and Madison counties. Prior to taking on the leadership role at OCM BOCES in August 2012, he served as a school superintendent, business administrator, building administrator, teacher, and coach in various districts. He is a seasoned school leader with over 30 years of experience. A 1999 Leadership Greater Syracuse graduate, Jody attended the State University of Buffalo from 1982 to 1986 and graduated with a Bachelor of Science degree in Education in 1986. Mr. Manning attended Syracuse University from 1986-1987 and graduated with a Master of Science degree in Education in 1987. He also earned a Certificate of Advanced Study from the State University of New York at Cortland and a Master of Arts/Sciences degree in Business Administration from LeMoyne College.

Several new programs have begun under Jody's leadership, including Central New York's first New Tech high schools, as well as embedded, technically endorsed Career and Technical Education programs, which are located in the area's businesses.

In 2015, Mr. Manning received the distinguished honor as the New York State Association for Women in Administration recipient of The Maxine Giacobbe Award. It awarded to those who demonstrate exceptional work with children from diverse populations, including children of color, to reduce gender inequalities and to promote outstanding achievement for children of color.

He came to St. John Fisher College in the summer of 2014 and began doctoral studies in the Ed.D. Program in Executive Leadership. Mr. Manning pursued his research in teaching and learning through project-based learning under the direction of Dr. Kim VanDerLinden and Dr. Dean Goewey and received the Ed.D. degree in 2016.

Abstract

A Nation at Risk (1983) asserted that American schools were failing. Subsequently, considerable efforts have been made to address the need for more innovative instruction. In order for students to meet the demands of the 21st century, project-based learning (PBL) could be the solution. PBL is as an instructional approach to education that is designed to engage students in the investigation of real-world problems.

The purpose of the study was to understand whether PBL positively impacts students' connection to their school, learning experiences, and preparation for college and career. This quantitative study included two groups of high school students. One group of students were immersed in a PBL program in their school, and the other group of students did not have a PBL program in their school. Every student in the two schools were exposed to the same curriculum throughout the duration of the research. This model made for a more logical comparison of the two schools. Students enrolled in the high schools were in Grades 9-11 and ranged in age from approximately 13 to 19-years old.

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Chapter 1: Introduction

Project-based learning (PBL) serves as an instructional approach designed to engage students in the investigation of real-world problems (Jones, Rasmussen, & Moffitt, 1997; Thomas, Mergendoller, & Michaelson, 1999). Despite reforms, such as *A Nation at Risk* (United States National Commission on Excellence in Education [US NCEE], 1983) and the *Race to the Top* initiative (United States Department of Education [USDOE], 2009), students are not learning and succeeding in the traditional school setting. As a result, many students are unable to achieve meaningful educational experiences. According to the U.S. Census Bureau, over 1.2 million students drop out of high school annually (U.S. Census Bureau, 2013). Therefore, it is imperative to explore alternative models of teaching that address the shortcomings of traditional methods of teaching.

PBL, as an alternative approach to conventional instruction, is one that may be responsive to the demands of the 21st century regarding new and innovative skills, which all students must acquire prior to becoming competitive members of the workforce. The model could also be a good way for students to gain knowledge that previously was not available to them, thus improving their response to 21st century demands and concerns. Because this model uses experiences and projects to help construct knowledge, students gain meaningful and relevant educational experiences. Given these earlier findings, which researchers in the field of education and instruction models have established, this

study examines the impact of PBL at the secondary level. It tests the hypothesis that PBL can be effective in the education of students within alternative high schools.

Statement of the Problem

After several attempts at educational reform, student achievement has not increased, and students are falling short in terms of college and career readiness (Stone-Johnson, 2015). Traditional teaching methods do not yield the intended results (Roderick, Nagaoka, & Coca, 2009). Alternate teaching methods, such as project-based learning, have the potential to enhance student engagement, learning experiences, and college and career readiness. In this study, PBL, as a viable alternative to traditional teaching methods and classroom environments, is examined. It determines whether PBL effects can better assist students in the preparation for college and career.

Theoretical Rationale

Experiential learning theory (ELT) (Kolb, 1984) provided the theoretical framework for this study. ELT defines learning as the process through which knowledge is created in the course of grasping and transforming of experiences. Kolb (1984) also described learning as an inherently adaptive and holistic process, because it provides conceptual bridges across life situations like school and work. ELT differentiates itself from other cognitive and behavior-learning theories through its focus on learning's "experiential" aspect, thus providing a distinct emphasis on the role that experience plays in the process of learning. It describes experimentation and experiences as the means through which people make sense of the world (Kolb, Boyatzis, & Mainemelis, 1999).

PBL, much like the ELT, is a model that places distinct focus on project-based and/or experience-based learning. Complex tasks, based on challenging problems that

involve the student in the design, decision-making, investigative activities, and problem-solving tasks, constitute the projects for this model. The model also provides students with the chance to work over certain periods of time and to produce concrete products (Thomas & Mergendoller, 2000).

The process and completion of the project, as guided by the PBL model, became the learning context. Similar to Kolb's (1984) ELT model, the learning context has significant meaning for both the learner and the audience. Completing the tasks in the classroom is a prerequisite to creating applications that go beyond the context of that classroom. Another essential component of PBL and ELT is collaboration. In this model, the experience of collaboratively working with other students toward a shared goal had a much larger influence than the individual experience (MaKinster, Barab, & Keating, 2001).

The ELT model provides a way of understanding how learning takes place in PBL by framing it on the basis of significant and authentic experiences. For meaningful learning to occur, educators must provide students with opportunities to leverage the knowledge students already possess so they can participate in activities that are significant both for them and the world around them (MaKinster et al., 2001).

Significance of the Study

College or career-ready students are the goal of every school district (Darling-Hammond, Wilhoit, & Pittenger, 2014). Discovering innovative ways to attain this goal is often a struggle (Rothman, 2012a). Districts' initiatives are wide, and they often extend to the community, state, and nation, and student achievement is often equated with funding (Darling-Hammond et al., 2014). This study is significant, because it affords empirical

evidence to support the effectiveness of project-based learning—that is, the contribution of PBL in improving learning experiences and career preparation. Subsequent theoretical and practical implications in the areas of curriculum design and resource allocation could result.

In the job market, experiential approaches found in PBL appear to be more effective in skills development, such as communication, the ability to work in teams, and workplace literacy (Lewis & Williams, 1994). New experiences leveraged with prior knowledge are essential to academic success. State and federal government agencies have historically held teachers accountable for what students know and are able to achieve. It is this accountability that has inspired teachers to find new instructional methods to teach students (Mitchell & Allen, 2014).

Purpose of the Study

The researcher studied an alternative high school where the students were completely immersed in project-based learning to determine whether PBL positively impacted the students' perceptions of their connection to the school, learning experience, and their preparation for college and career.

Research Questions

In order to explore whether students, who are engaged in project-based learning, report different experiences and outcomes compared to students who are not engaged in project-based learning, the following questions guided the research study:

1. In comparison to students who do not participate in project-based learning, to what extent do high school students who participate in project-based learning report a greater connection to their school?

2. In comparison to students who do not participate in project-based learning, to what extent do high school students who participate in project-based learning report working better with others to solve problems?
3. In comparison to students who do not participate in project-based learning, to what extent do high school students who participate in project-based learning report that they are better prepared for college and career?

Definitions of Terms

Alternative High School – an educational establishment where teaching methods are not traditional. These organizations adopt a more comprehensive and flexible educational curriculum in comparison to traditional schools that enable them to achieve a variety of educational goals such as social skill development.

College and Career Readiness – students are aware, eligible, and prepared for the post-secondary option of their choosing. Being prepared for the demands of college, career, and civic life. Preparedness includes not only academic content knowledge and problem-solving skills, but it is also includes the communication and personal agency skills to attain personal goals.

Experiential Learning Theory (ELT) – the process through which knowledge is attained by the grasping and transforming of experiences.

High School – an educational establishment that provides students, usually between the ages of 15 and 19, with part or all of their secondary education in Grades 9-12.

Project-Based Learning (PBL) – a model that arranges education around projects. Projects consist of complex tasks based on challenging questions or problems that

involve students in design, problem-solving, decision making, or investigative activities, and it allows for student autonomy on work over extended periods of time, ending with a product or presentation.

Problem Solving – the development of working through details of a difficult-to-reach resolution.

School Connectedness – academic environment in which students believe that adults in the school care about their learning and about them as individuals.

Summary of Remaining Chapters

Chapter 1 showed that research suggests that project-based learning has the potential to impact students positively. Few studies have examined project-based learning with high school students, and no studies were found, specifically, that examined project-based learning in an alternative high school. Therefore, this study attempts to fill that gap and add to our understanding of students' perceptions of project-based learning.

Chapter 2 is a review of the literature that provides an analysis and synthesis of research articles related to PBL. Chapter 3 discusses the research design and methodology developed specifically to investigate the phenomenon and provides answers to the research question. Chapter 4 discloses the findings produced by the research, and Chapter 5 offers recommendations developed from the research results.

Chapter 2: Review of the Literature

Introduction and Purpose

The purpose of the study is to understand whether PBL positively impacts students' connection to the school, their learning experiences, and their preparation for college and career. This section presents the review of related literature, which serves as the foundation for this study.

The literature review covers several major themes. It starts with the state of the secondary schools in the nation and why the literature serves as an important context to the study. It discusses the development of the alternative high school as well as reform methods, such as the No Child Left Behind Act. Following this is a presentation of the studies on project-based learning. A discussion covers the studies comparing project-based learning outcomes to other learning methods. There is a review of the studies that looked into the effects of project-based learning on college and career readiness and on academic motivation. The research also presents criticisms of project-based learning.

Topic Analysis

Secondary schools in the United States. This study focuses on the use of PBL in high school education. This section discusses the existing state of secondary schools in the United States and why it is an important context to study project-based learning's effectiveness. According to researchers, high school is a level of education rarely studied and explored (Savoie, Bruter, & Frijhoff, 2004). According to Savoie et al. (2004), secondary education developed as a parallel to Renaissance institutions of learning.

During the Renaissance, young individuals only acquired formal education in very specific instances, when they trained with masters and in groups, in order to achieve certain skills and capacities necessary for their future occupations.

As education became more sectored in the 18th century, the term "secondary education" began to refer to schools that taught a general curriculum for the development of the future elite. At this point, education was becoming recognized as an important component for participation in the success of an individual and of society. Individuals sought education in order to ensure successful futures. Hence, most of the individuals who acquired education were members of the elite who wanted to preserve their status in society as well as the prevailing societal structures.

At the turn of the 19th century, secondary education began to encompass subjects and lessons more attuned with the demands of tertiary education, which is where students specialized their skills and career tracks. This exerted pressure on secondary education institutions to give students the necessary skills to understand and meet the demands of tertiary education. Savoie et al. (2004) added that from then on, secondary education encompassed schooling offered to adolescents in order to prepare them for either tertiary education or for their chosen vocations and professions.

Eubanks and Eubanks (2001) noted that the United Nations Educational, Scientific and Cultural Organization (UNESCO) recognizes secondary education as that stage in an individual's schooling that succeeds the 6 years comprising primary or basic education. According to UNESCO, because primary education is focused on creating basic knowledge among all students and gives them the necessary skills to successfully function in their daily lives, secondary education aims to instill knowledge among

students that comprises more than tools for survival (Eubanks & Eubanks, 2001). The researchers noted that despite varying standards and practices among different countries, in general, the youth around the world receive secondary education during adolescence and the teenage years.

According to UNESCO, secondary education should be divided into two further sub-stages of schooling (Eubanks & Eubanks, 2001). The first sub-stage refers to lower secondary education, while the second sub-stage is called higher secondary education. For many countries around the world and based on local laws and standards, the end of lower secondary education marks the end of compulsory education. The lower secondary education immediately succeeds primary education, and it is generally directed at students between the ages of 11 and 15. On the other hand, higher secondary education, which succeeds lower secondary education, is directed at students between the ages of 15 and 19 (Eubanks & Eubanks, 2001).

The purpose of lower secondary education, according to UNESCO, is to provide more specific and concrete learning compared to the basic education levels that precede it (Eubanks & Eubanks, 2001). This objective means that lower secondary education levels often employ teachers who are more specialized in their knowledge and who teach subject matter that requires specialization, specificity, skills, and knowledge. Unlike basic education, where teachers can generally instruct on subject areas not assigned to them, in lower secondary education, both teachers and subject matter are more specialized, making instruction more specific.

UNESCO views higher secondary education as the non-compulsory stage of schooling (Eubanks & Eubanks, 2001). This means that after experiencing the first 2

years of education, many students around the world are no longer compelled to take part in its succeeding stage. However, this does not mean that higher secondary education is not without its merits. In general, this stage of schooling extends subject-specific instruction, thus requiring more specialized instructors. However, the main focus of higher secondary education is to provide a proper venue for students to acquire skills and knowledge in order to be successful in any of the following paths: direct entry into the workforce, engagement in post-secondary vocational studies, and enrollment in programs for tertiary education (Eubanks & Eubanks, 2001).

Development of alternative high schools. The term alternative education covers all educational activities that are not included in the traditional K-12 school. Some examples of these are home schooling, GED preparation programs, programs designed for gifted children, and charter schools. Alternative education is also used to characterize programs that cater to students who are no longer in traditional schools. According to the Common Core of Data, which is the U.S. Department of Education's (USDOE) (2002) main database on public elementary and high school education, the definition of an alternative education school is:

> A public elementary/secondary school that addresses needs of students that typically cannot be met in a regular school, provides nontraditional education, serves as an adjunct to a regular school, or falls outside the categories of regular, special education or vocational education. (USDOE, 2000, p. 14)

For the 2007-2008 school year, there were 10,900 alternative schools and programs operating to serve approximately 646,500 students in the US. Moreover, there

were about 10,300 alternative schools or programs that catered to at-risk students within the same time frame (National Center for Educational Statistics, 2010).

Alternative education has existed since the beginning of public education, which included private schools, parochial schools, and home-schooling alternatives. The types of alternative education that are more recognizable today began in the 1950s and early 1960s (Tissington, 2006). During the 1950s and 1960s, some people chose alternative education because various spheres, including government and the population as a whole, were critical of traditional education.

Early proponents of alternative education were Jean-Jacques Rousseau (1712 - 1778), Johann Heinrich Pestalozzi (1746 – 1827), and Friedrich Froebel (1782 – 1852) (Miller, 2004). They believed that students should receive the type of schooling that supported their natural growth instead of social structure (Lange & Sletten, 2002). Yet, the movement halted during the Cold War era, especially after the launching of Sputnik in 1957, when the political drive for technological superiority was stronger (Howlett, 2013).

By the 1960s, alternative education had become a full-blown movement toward social and civil rights. By the late 1960s, the alternative education movement began inside and outside of the public school system (Lange & Sletten, 2002) and alternative school programs outside public education were put into place. They were called the Freedom Schools (Tissington, 2006). These schools were operated in churches, community centers, and even storefronts, so that children had increased access and flexibility to learn. Freedom Schools were considered the direct opposite of public school systems, which civil rights groups called uncaring and unresponsive to the plight of many

students, especially those belonging to minority groups (Lange & Sletten, 2002). However, Freedom Schools, despite having idealistic and lofty goals, had a short lifespan (Raywid, 1981; Young, 1990), and despite not having a long run, Freedom Schools and other non-public alternative-education programs served to stimulate reforms within the public school system, and they laid a strong foundation for the present alternative-education programs.

The late 1960s to 1970s saw alternative forms of education proliferate more and become widespread across the United States (Miller, 1995). During the 1970s, the number of alternative schools jumped from 100 to more than 10,000 (Raywid, 1981). Moreover, even though there were many forms of alternative education then, two of the most important traits characterizing alternative schools were that they catered to a group of students who were not responding optimally to a regular school program, and they catered to students who were departing from standard school organizations, programs, and environments. The most prominent alternative schools in the 1970s were the "open schools" (Raywid, 1994). According to Raywid, these early alternative schools offered choice-based learning alternatives. They offered non-competitive evaluation and child-centered curriculum to the parents, students, and even the teachers (Young, 1990).

In such open programs, students were allowed to learn autonomously without critical evaluation (Lange & Sletten, 2002; Tissington, 2006). Under the open school movement, various alternative education program models emerged, such as schools without walls, schools within a school, multicultural schools, continuation schools, learning centers, fundamental schools, and magnet schools (Doran, 2005). Most of these programs strived to meet the societal need for equal educational opportunities.

The open school concept thrived in the 1970s and the 1980s. It saw the creation of programs such as schools without walls, schools within school, multicultural schools, and magnet schools. Even though the concept became outdated in the 1980s, some of the components and ideologies the open school concept espoused still exist today (van Acker, 2007). The focus of alternative schools in the 1980s changed from the creativity of open schools to one that specifically catered to students who were not performing well and were disruptive in traditional classrooms (Raywid, 1994). The previous decade's emphasis on liberal approaches to instruction were abandoned and shifted to teaching the basics of reading, writing, and arithmetic in the 1980s. One of the important contexts of the application for PBL is in secondary education where students experience increases in the difficulty of their studies, and therefore, they need different teaching approaches to transfer knowledge (Egenrieder, 2010).

Recent reform efforts. Several reforms in the United States have significantly influenced secondary education. Despite these efforts at educational reforms, student achievement has not increased (Stone-Johnson, 2015). Therefore, it is imperative to explore the key educational reforms and the reasons for their failure in order to understand if project-based learning, as an alternative teaching method, proposes to address the deficiencies left behind by the previous reforms. Analysis of the key reforms, such as the No Child Left Behind Act (NCLB) and the Common Core State Standards, provide the background against which the efficacy of project-based learning, as an alternative to conventional teaching methods, can be better understood.

One of the most significant developments in modern secondary education was the enactment of the No Child Left Behind Act (NCLB) in 2002, which was enforced

throughout the 2000s. NCLB was a response to the declining standards of education and educational achievement in the United States. Gius (2012) explained that the No Child Left Behind Act was a measure through which the federal government presumed it could ensure the success of public school education. It linked students' basic education to federal funds in order for academic standards across the United States to improve. NCLB mandated that public school students must be tested each year in order to determine whether or not they met the federal standards of achievement.

According to Davidson, Reback, Rockoff, and Schwartz (2012), despite earnest efforts among federal and state government units to improve educational standards pursuant to NCLB, many states failed to meet the required standards. According to the researchers, the rates of failure in diverse schools and states are so disparate that it appears that different educational institutions have different ideas or ways for implementing NCLB. This lack of a more precise framework for implementation of NCLB has done nothing to prepare students better for tertiary education or for the workplace, making these concerns common among educators and learners alike.

The lack of a proper framework for addressing the needs of 21st century education caused the ineffectiveness of NCLB (Davidson et al., 2012). Simply using existing models and methods for instruction is no longer enough to help students meet the demands of globalization and the workforce. Williams (2014) emphasized that high school education needs to improve with the help of instructors and educational methods that properly adapt to the needs of students and the different teaching approaches. Students are also experiencing difficulty in high school because of the more difficult topics being introduced and the diverse pressures in their academic and personal lives.

Because they experience subject matter that is more difficult and complicated to study, the students are prone to lower levels of academic performance (Egenrieder, 2010).

Even with the noble attempt to ensure that all students had clear learning goals and highly qualified educators to teach them, in many ways NCLB failed (Darling-Hammond, 2007). A significant adverse effect of NCLB is that teachers start to instruct their students so that what they learn is mainly what will constitute the content of the mandated tests (Guilfoyle, 2006). Hudson (2012) described this as having a "robotic view of children," (para. 3) where teachers' effectiveness and students' successes are mainly measured through test scores.

The Common Core State Standards were created to ameliorate some of the issues of teaching, learning, and testing. It was released for the first time to the public in March 2010 by the combined efforts of the National Governors Association (NGA) (2010). The Council of Chief State School Officers (CCSSO) provided voluntary standards that were designed to offer clear academic benchmarks for essential learning by students to prepare them for college and their respective, chosen careers (Achieve Diploma Project Network [Achieve], 2012). The standards were developed by taking into account the standards adhered to by top-performing countries, as well as the strengths of the existing state standards already in place (Illinois State Board of Education, 2011; Reeves, 2011). The CCSSO has been adopted by 45 states as well as the District of Columbia (CCSSO, 2011), and it has been backed by well-known businesses and foundations.

The main goal of the CCSSO is to make education equitable for all (Achieve, 2012), which ideally means that all students should have fair access to resources and opportunities. Ideally, this means that all students should have a fair chance of being

successful. According to Rothman (2011), under the standards of the CCSSO, expectations are similar for all students—no matter their backgrounds. Furthermore, regardless of where a student lives, the standards are the same, ensuring consistency. This is believed to be an improvement over NCLB, because it ensures that no child will be disadvantaged because of his or her individual state's standards (Delpit, 2003). The original proponents of the standards believed that, unlike previous reforms that had different levels of rigor, the CCSSO could provide students, nationwide, with both common knowledge and mobility. Unlike NCLB, the CCSSO standards do not detail exactly how the students can meet goals. Students do not have to focus on just passing the standardized tests. Rather, they have to "articulate the fundamentals" (CCSSO, 2011, para. 6). Teachers under the CCSSO have more flexibility and room to apply new understandings of teaching and learning than under NCLB. Teachers are not strictly mandated just to teach specific content on a specific day. Under NCLB, teachers needed to adhere to strict pacing guidelines and daily teaching scripts, so there was no flexibility (Van Roekel, 2012). Ideally, therefore, the CCSSO can also lead to effective teachers, because it gives educators opportunities to integrate the ideas of equity and social justice. This may have demonstrated success in improving achievement levels in schools that have been considered failing schools under NCLB (Luke et al., 2013). Teachers have claimed that integrating culturally relevant lessons have led to improvements in their students (Luke et al., 2013). In addition, the implementation of the CCSSO will raise the bar for what is considered quality and effective teaching from the existing and future educators (Gewertz, 2012).

Another advantage is that CCSSO should lead to increased collaboration and improved tools and materials, such as the Common Core 360 (Rothman, 2012a). Content editors can design professional development and materials to benefit most teachers, unlike before, when each state had its own standards of training and tools for instruction (Samtani, 2012). However, even with these praises for CCSSO, there were also some early criticisms (Murphy & Regenstein, 2012). According to Murphy and Regenstein, there were varying levels of implementation of the CCSSO. States approached implementation of the CCSSO as business as usual by still using hard copy textbooks, paper tests, and face-to-face professional development. CCSSO also expected states to cut down costs by mainly using online and open-source materials and resources. Lastly, some states likely used a combination of traditional and bare-bones resources when implementing the standards.

With these three possible scenarios, Murphy and Regenstein (2012) expected that an equitable education, aimed by the CCSSO would be undermined, because each state had its own approaches to teacher training, use of materials, and overall learning experiences for its students. Moreover, because the CCSSO was also designed to prepare students with 21st century skills, curriculum relied heavily on technology integration in the classroom. Some of the assessments were designed to be given in a digital format (Rothman, 2012b). However, it was expected that not all schools were well prepared to embrace their reliance on using technologies (Rothman, 2012a). With CCSSO, more costs and effort are required to encourage successful implementation, education, and professional development for teachers (Gewertz, 2013). Even if CCSSO can lead to

increased collaboration, this can be problematic because teachers need time to collaborate (Gewertz, 2012).

Another potential problem is that equity in students' learning experiences and teachers' training could be counterproductive. This is because each community throughout the nation has its own distinctive population size to which the respective schools must cater, and as such, centralized decisions about what should be included in teacher training under the CCSSO can lead to adverse results. According to Darling-Hammond (2010), equity in education is hard to achieve, because there are no systematic ways of doing it. Kober and Rentner (2011) also claimed that many states are not prepared to align their teacher education programs with the CCSSO. While teachers are not going to be teaching to the standards, which is a good thing, teachers empowered by administrators to design the curriculum and make instructional decisions need to have more knowledge and training on how to proceed (Kober & Rentner, 2011).

Both of these reforms showed that, despite the increased attention on the quality of U.S. education, more still needs to be done to improve and increase students' academic achievement levels in the US. According to Ravitz (2009), who analyzed the findings from national surveys regarding the reforms instituted in high schools throughout the United States, not all schools have employed PBL as part of their educational reforms. This may explain the continuous low academic achievement in U.S. schools.

Project-based learning. Project-based learning is not a new pedagogical concept. It is a model that organizes learning around projects. Project-based learning serves as an instructional approach designed to engage students in the investigation of real-world problems (Jones et al., 1997; Thomas et al., 1999). According to Eskrootchi and Oskrochi

(2010), previous researchers have established that the main function of education is to transfer knowledge to learners. Traditionally, within formal school settings, this transfer of knowledge occurred through a process of an instructor supplying all of the information required by the students, and the students memorized the given information. However, through academic and scientific inquiry, educators and academics began to realize that the traditional mode of knowledge transfer was not sufficient to meet the needs of all students. Eskrootchi and Oskrochi noted that many educators believed that in order for knowledge transfer to occur, and for students to achieve stated learning outcomes, the students must have real-life experiences that echo the skills and situations they will face in the future. Specifically, students, educators, and academics have agreed that teaching students by exposing them to projects that echo real-life situations and skills is one of the most effective means of achieving knowledge transfer (Eskrootchi & Oskrochi, 2010).

According to Tamim and Grant (2013), PBL is, first and foremost, a model of instruction that entails knowledge construction within a social activity that, then, leads to self-awareness of learning. The researchers conducted a descriptive case study regarding teachers using PBL while instructing high school students. Tamim and Grant interviewed six teachers from Grades 4-12, in both public and private schools. on their in-service definitions of PBL. They found differences in how teachers implemented PBL based on teaching and learning philosophies. The researchers conducted an inductive analysis on the findings of the case study. From the inductive analysis, they derived three themes that were significant experiences of teachers when applying PBL. First, the teachers were acutely aware of the benefits of PBL, and they defined PBL based on its benefits and not on its more academic definition or designation. Second, teachers varied in their use of

PBL—not merely among one another, but also throughout the course of time. This means that throughout the course of an academic year, teachers would apply PBL in different ways for his or her students. Hence, teachers can apply PBL in a variety of manners. Finally, the researchers observed that teachers adapted PBL methods in response to the needs of the students (Tamim & Grant, 2013). Therefore, the different ways in which teachers apply PBL are often the result of what they perceive to be the level of their pupils' performance.

PBL involves solving open-ended problems and applying self-directed learning. In addition, PBL is grounded in experience and in the construction of knowledge that is based on how the learner perceives a particular context (Tamim & Grant, 2013). The model relies on an active knowledge on the part of the learner so that he or she is acquiring and building information from the experience and context. Various academics and researchers have studied PBL in the high school setting as a method of instruction, yielding mixed results.

Effects of project-based learning on students' academic performance. Several researchers have compared the performance of students receiving PBL instruction and those receiving traditional models of education and they found generally positive results (Mergendoller, Maxwell, & Bellisimo, 2006; Prosser & Sze, 2014). There were those who found significant effects of PBL on students' academic performance, while some found no significant changes compared to traditional education. For example, Prosser and Sze (2014) attempted to understand the effects of PBL instruction on student performance compared to traditional methods of instruction. The researchers conducted a meta-analysis of the input-output studies of PBL in comparison with traditional approaches.

They also provided a summary of "qualitative, phenomenographic, and factor analytic analyses of student experiences when studying health sciences (dentistry and medicine) using PBL curricula" (Prosser & Sze, 2014, p. 139). Based on their meta-analysis, they found that traditional teaching methods were more suitable for the instruction of topics and for content that was to be used and remembered for only a short period of time. The results of their study established that after a lapse of time, students often forgot information learned using traditional methods of instruction. However, when PBL was used to provide instruction, students become better prepared for the future use of the information (Prosser & Sze, 2014). The researchers found sufficient information to conclude that in terms of preparing for future events and for future performance, PBL created better learning experiences that allowed students to access concepts and topics even after the lapse of a considerable period of time. Even with significant results, Prosser and Sze (2014) did not completely relegate the effects of traditional teaching methods as sub-par compared to the effects of PBL. In fact, they noted that traditional methods of instruction were better suited for more short-term learning and memory retention.

Mergendoller et al. (2006) also compared PBL to traditional instructional approaches in shaping high school students' knowledge in macroeconomics. The researchers wanted to determine the effectiveness of PBL on four aptitudes of the students: verbal ability, interest in economics, preference for group work, and ability to solve problems. The PBL instructional approach came in the form of a series of curricular units targeting knowledge concepts as well as principles that were being taught in American high school economics curriculums. Researchers ran each of the units from just

1 day to 3 weeks to create a variable effect on teacher and student behavior. Each unit consisted of seven interlinked phases of problem framing, knowledge inventory, problem research and resources, problem twist, problem length, problem exit, and a problem debriefing. Students who were grouped into teams generally went through the phases in a linear form. However, they could go back to the previous phases, or they could remain for a longer period of time in a single phase if they encountered difficulties associated with the problem (Mergendoller et al., 2006). With such a detailed account of how students underwent project-based learning, Mergendoller et al. (2006) found that PBL is the most effective method compared to the traditional method. In particular, students with average or below-average verbal ability benefited the most. PBL benefited students who were already very interested in learning economics as well as the students who were not confident with the capacity to solve problems. Overall, the researchers established that PBL was an effective approach for students who were at both extremes of the spectrum when it came to problem-solving capabilities, because it benefited those who were extremely confident and those who were the least confident in their abilities to solve economics-related problems (Mergendoller et al., 2006).

Eskrootchi and Oskrochi (2010) conducted a quasi-experiment in order to verify whether PBL led to more successful student outcomes in a technology-rich environment. They specifically focused on a science project called the Land-use in Watershed. Under this project, the Internet was used extensively and integrated through a simulation-software package, the Structural Thinking and Experiential Learning Laboratory with Animation (STELLA). After the researchers gathered data from 72 students, results revealed that those who participated in the project-based learning model of the watershed

experiment and the STELLA stimulation understood the watershed concept the best (Eskrootchi & Oskrochi, 2010).

In another study, Galvao, Silva, Neiva, Ribeiro, and Pereira (2014) carried out a meta-analysis using a random-effects model to determine the effectiveness of PBL. Through a systematic search for controlled studies about PBL in literature databases up to January 2014 that yielded 1,988 records, five studies were selected. Meta-analyses were performed on the data extracted from the selected studies. The researchers found that to apply PBL effectively in schools, teachers and administrators had to be mindful of the different contexts under which the use of PBL flourishes. From their meta-analysis, Galvao et al. (2014) found that, in general, PBL is positively linked with student performance in academic endeavors and in their preparation for future professions and disciplines. This makes the mode of instruction an important consideration in the development of curricula and in the delivery of teaching materials.

Parker et al. (2011) examined the supporting evidence established in the literature regarding the effects of PBL on the studies of high school students in a suburban school district in the United States Pacific Northwest. The researchers conducted a mixed-methods, quasi-experimental design experiment regarding the effects of traditional methods of instruction and PBL on high school students taking advanced placement (AP) politics classes. Both quantitative and qualitative data were gathered and analyzed. The college board administered the AP test and the Complex Scenario Test, which were used to collect the quantitative data. In addition, end-of-year group interviews were conducted with students in the PBL classes. Results indicate that a course of semi-repetitive, content-rich project cycles can generate higher or at least the same scores on AP exams.

Moreover, such a course can enable students to have deeper conceptual learning (Parker et al., 2011).

Sockalingam and Schmidt (2011) explored specifically how PBL could improve students' academic experiences. They explored the salient problems that students perceived in a problem-based curriculum and found that the students' practice of determining problems under a PBL program can lead to improved analysis and reasoning capabilities. These skills are critical for their academic performance and even for their success outside of school (Sockalingam & Schmidt, 2011).

In another study, Han, Capraro, and Capraro (2014) examined PBL in a setting where teachers instructed high school students in science, technology, and mathematics. The researchers found important information regarding the effects of factors inherent in the students that modified the effects of PBL. Their study established the importance of studying other factors outside of PBL in order to improve learning and instruction. In a quantitative, longitudinal study, Han et al. (2014) asked three high school teachers to receive PBL training from a university and to implement this mode of instruction into their teaching once every 6 weeks for 3 years for 836 high school students. The researchers wanted to understand whether students' level of performance increased after receiving PBL. Han et al. hypothesized that students who had different levels of academic performance would most likely also have different rates of improvement after receiving PBL instruction. According to the analysis conducted by the researchers, those students who initially were the lowest performing in terms of academic achievement were the ones who had the best improvement rates over the 3 years, which was due to repeated exposure to PBL. Based purely on the rate of increase in their grades and test scores after

the administration of PBL instruction, PBL most benefited those who had performed poorly (Han et al., 2014).

Attitude and performance in science, technology, engineering and math (STEM) courses. Some studies have shown that PBL can lead to improved learning experiences and academic attitudes in STEM courses as well (Boaler, 2002; Carney-Strahler, 2011; Lou et al., 2011). Boaler (2002) found that implementation of PBL in a high school increased performance in mathematics over a 3-year period when compared to a traditional classroom. Carney-Strahler (2011) expanded on the existing knowledge of PBL by conducting a systematic literature review of academic findings regarding PBL and technology. Carney-Strahler noted that among many high school students, technology had become an important part of daily living and learning. The research showed that younger students were so adept at using different technological tools that they could communicate easily, share information with one another, and direct their own learning with the help of these tools and advances in technology. According to Carney-Strahler (2011), educators should take advantage of technological advances in order to develop the literacy of high school students through PBL. Based on the available literature, Carney-Strahler claimed that the positive effects of PBL on literacy are already well-founded, but they may be augmented with the use of technological advances, such as social networks, like wikis, for information sharing. Wikis that allow for the active sharing of information among students, as recommended by Carney-Strahler (2011), can contribute significantly to students' learning and, thus, contribute to their literacy at the high school level.

Lou et al. (2011) explored how PBL actually worked among high school students who were attempting to solve a series of problems using science, technology, and mathematics knowledge that they learned through PBL-based instruction. The researchers designed the problems to be presented and solved in an online platform. Specifically, 84 high school students agreed to take part in PBL instruction and in the subsequent problem-solving exercises. Researchers divided these participants into 21 groups of four, with the members of each group having to work collaboratively in order to fulfill the required tasks. They collected surveys from the participants in order to measure their understanding and comprehension of the information presented and taught using PBL.

Lou et al. (2011) noted that most students learned successfully through the PBL method of instruction, as evidenced by their responses in the survey questionnaires administered to them. Specifically, the researchers found that instruction using PBL positively improved the intention of students to enter the fields of science, technology, and mathematics. It also positively improved their cognition. Moreover, the students were inspired to have further interest in the fields of science, technology, and mathematics. However, Lou et al. (2011), pointed out that the success of the PBL instruction might be modified by the inherent attitude of students. The researchers noted that when students had a positive attitude regarding science, technology, and mathematics, as well as the instruction and exercise presented, they also had better chances of comprehending the information properly and becoming more interested in the concepts being taught. They recommended the model be integrated into science, technology, and mathematics instruction. If PBL, indeed, helps improve the behavioral intention or interest of students, and this interest, in turn, modifies and improves the positive effects of PBL, then

introducing PBL earlier on in students' academic lives will likely help them have the proper attitudes for future endeavors. These attitudes might help them in terms of overall academic performance and success (Lou et al., 2011).

Dischino, DeLaura, Donnelly, Massa, and Hanes (2011) conducted a project that partnered STEM teachers from high schools with faculty from 3- and 4-year institutions of higher education from New England and across the country. Pre-service teachers were tasked to develop an original multimedia PBL challenge, according to their preference, that would work best with a STEM topic This project was built on the lessons learned from another previous project, that is, the PHOTON PBL project (Donnelly, Dischino, Hanes, & Massa, 2009). Pilot test results revealed that students who had greater exposure to PBL challenges demonstrated greater conceptual knowledge and problem-solving abilities.

Tseng, Chang, Lou, and Chen (2013) enlisted the help of 30 engineering students in Taiwan who had to collaborate in five groups in order to complete a particular task. Through questionnaires and semi-structured interviews that examined student attitudes toward STEM before and after the PBL activity, the researchers found that after their collaboration in the project, the students had strong positive experiences and recommended the use of collaborative projects in order to successfully learn certain concepts in engineering. In general, according to the researchers, PBL helped improve student attitudes regarding STEM courses.

In a study conducted by McCright (2012), the researcher dealt with instructing students regarding sustainability and environmental concerns. McCright conducted a quasi-experimental study among 157 students who were attending a college course on

science and environmental concerns, with some undergoing a semester-long, problem-based learning project. Based on the findings, the students who underwent the PBL instruction had better knowledge of statistical processes and skills. The students also had better research skills and more opportunities to practice the values and attitudes necessary to successfully carry out research endeavors. Finally, McCright (2012) found that the students who received the PBL instruction had more respect for collaboration with other fields of science such as sociology and the social sciences.

Students' satisfaction levels. Palmer and Hall (2011) conducted a study that evaluated student perceptions of PBL instruction and found positive results regarding student satisfaction. The researchers conducted surveys with 72 high school students receiving PBL instruction throughout their curriculum and found that most of the students were satisfied with PBL. According to the analysis conducted by the researchers, students felt positive and enjoyed PBL. More importantly, the researchers noted that when implemented correctly, PBL allowed each and every student to have the same level of engagement and participation (Palmer & Hall, 2011).

Dabbagh and Blijd (2010) conducted another study that assessed the effects of PBL on student satisfaction. The researchers assessed PBL from the standpoint of the students. They looked at 11 students' perceptions of their own learning experiences as they completed a real-world instructional design project while working in a performance-oriented team. The students were all learning in a PBL environment and were working to create a system that would offer online training to underground coal mine supervisors. The project was supported for 2 years by the Mine Safety and Health Administration (MSHA) agency under the U.S. Department of Labor. The participants who were

enrolled in the 2005-2006 immersion program and participated in the MSHA project were required to transform the existing underground coal mine supervisor's job task analysis to make it more effective. Researchers asked students to share perceptions of their project and their learning experience. Dabbagh and Blijd found that, overall, students had positive views of their learning experiences, even when they were met with certain difficulties. Complexities in the project were often linked to managing expectations, which made students feel anxious and confused, but in general, they were satisfied with their learning experiences because of the PBL (Dabbagh & Blijd, 2010).

Students' engagement levels. Papanikolaou and Boubouka (2010) evaluated the engagement of 82 students at different stages of their collaboration on a PBL task. The researchers counted the number of responses students posted in a particular e-forum throughout the task. They found that these responses varied depending on certain factors, including the type of roles each student undertook, the phase of the project, the activity's goals, and the sequence of tasks assigned to the students. Overall, Papanikolaou and Boubouka found that students' engagement levels increased over time. They were more inclined to respond in forums and take on more critical roles in their academic activities.

According to Holm (2011), one of the most important contributions of PBL for students in high school is its ability to engage them in their studies. Holm conducted a review of research (2000-2011) regarding the effectiveness of project-based instruction in preschool, elementary, and secondary school classroom settings. Results of the review revealed that when educators used PBL at the high school level, students tended to become more interested in their own studies and more involved with the process of education. Furthermore, Holm noted that most of the studies revealed that, among high

school students, PBL also developed better problem-solving skills and greater levels of knowledge and skill transfer. Thus, among high school students, PBL prepared them with the skills necessary for later in life (Holm, 2011).

Belland, Ertmer, and Simons (2006) claimed that student-engagement levels under PBL can also increase in students with disabilities. They specifically investigated how middle-school students with mild, moderate, and severe disabilities perceived the importance of participating in a PBL unit. The middle school employed 36 teachers and educated 600 students. Researchers interviewed the participants, who had special needs, individually using questions on cooperative and constructivist learning. The researchers found that students who experienced PBL had stronger engagement levels, and students with less-severe disabilities acquired more compassion and understanding of their counterparts with more severe disabilities (Belland et al., 2006).

Johnson and Delawsky (2013) further investigated this method of education's effects on student engagement levels. However, unlike previous researchers, they made a distinction between the types of student engagement: emotional, cognitive, and behavioral engagement. The researchers hypothesized that based on earlier literature, PBL-instructed students might exhibit increased academic engagement levels. They found that PBL affected both cognitive and behavioral engagement levels but not the emotional engagement of the students. However, the analyses of the findings revealed that students who received PBL instruction did not perform significantly better in measures of educational engagement. Therefore, the researchers recommended further research to verify the actual effects that PBL has on varying aspects of academic engagement.

Students' self-efficacy and motivation. Studies also showed that PBL can increase students' self-efficacy levels, which means it improves their motivation to learn and enhances their beliefs that they can perform well in their academic activities. Bell (2010) conducted a systematic review of the literature to identify the skills characterized as most beneficial from PBL. Bell searched for studies about PBL and synthesized the findings according to the different categories of learning: self-reliance, enhancing collaboration skills, differentiating intrinsic motivation, and application of PBL. According to Bell, PBL compels students to make better inquiries into the topics of study. It improves students' self-efficacy and motivation levels, making them rely on themselves, as well as on their peers, in order to achieve the desired outcomes of a project. PBL also improves other skills necessary in the conduction of projects such as personal researching and proper communication with peers (Bell, 2010).

Bagheri, Ali, Abdullah, and Daud (2013) reinforced the research findings of Bell (2010). Bagheri et al. (2013) carried out a true experiment consisting of 78 different students. The instructors taught one group using PBL. They taught another group using the conventional teaching (CT) methods of main-stream education. Bagheri et al. (2013) utilized a self-directed, learning-readiness scale (SDLRS) three times (i.e., pretest, post-test one, and post-test two). Based on their analysis of the pre- and post-tests, the researchers concluded that the students who received PBL were statistically more successful with respect to their self-direction and self-efficacy than the students who were taught using the CT method. Further, Bagheri et al. (2013) found that students who received PBL became more independent and autonomous with respect to their learning and academic outcomes, and they were capable of taking the initiative to work

independently. Without such independence, students tended to rely on their instructors for the information that they needed to learn, without exerting much effort to understand it for themselves (Bagheri et al., 2013).

Ocak and Uluyol (2010) examined how PBL affects student motivation, especially throughout the course of a college curriculum. In order to gather data, the researchers used a case study method that incorporated both quantitative and qualitative data collection procedures. The researchers studied a sample of 55 students, who were enrolled in a college curriculum, over a period of 14 weeks as they received PBL instruction. Based on their findings, Ocak and Uluyol noted that there were strong positive relationships between the students who received PBL instruction and the interest that students showed regarding the topics discussed in class. According to the researchers, when students were exposed to PBL, their motivation levels toward a particular topic or lesson also increased. However, results were not as strong for PBL instruction and cognitive engagement, meaning that when students received PBL, the mental focus they gave a particular lesson also increased, but not as much as the increase for traditional teaching and student interest. Hence, the researchers recommended that any curricula designed with PBL as a guiding framework must be constructed carefully to ensure full motivation among students (Ocak & Uluyol, 2010).

College and career readiness. PBL has important effects on the preparation of students for future professions and careers (Etherington, 2010). In a qualitative study conducted by Etherington, the researcher attempted to understand the different effects of PBL on potential teachers' learning about science before they applied this knowledge as instructors. The study reported on the first attempt to incorporate the PBL mode of

teaching into an undergraduate primary school teacher's education course at an Australian University. The course had 150 pre-service teachers enrolled when the pilot study was undertaken. They received PBL instruction to teach primary school science. Over the course of the semester, the students were asked to find solutions to a particular problem, and that problem became the main basis for their learning and instruction. According to the experience of four pre-service teachers reported in the study, having the project and the PBL instruction led to several positive effects on their attitudes and psychological approach to teaching. The teachers reported feeling more inspired and more interested in teaching primary school science because of their experiences with PBL instruction throughout the semester. Etherington (2010) attributed the increase in the teachers' interests and inspiration to the fact that they received PBL instruction and were asked to apply PBL instruction in solving a real-world problem.

Etherington (2010) also noted that the participants in the study became more prepared to use what they learned about teaching elementary science in real-world scenarios. The researcher concluded that apart from increasing academic performance and preparation, PBL has the capability to increase a learner's capacity to apply knowledge to future fields of interest and disciplines. Etherington recommended the inclusion of PBL in various curricula for teaching disciplines and professions that have real-world applications, such as the education of teachers and instructors.

Aside from Etherington (2010), there were also other studies that showed PBL can increase college preparedness and career readiness. Jabbari, Bakhshian, Alizadeh, Alikhah, & Behzad (2012) conducted a study to measure the actual relationships of PBL on the preparation of students for future career endeavors. One of the measures the

researchers used to quantify the learning of students was a national science test, which was administered 2 years after the students received the PBL or the lecture-based instruction. In these national examinations, students who had received PBL instruction scored significantly higher compared to their peers who had not received PBL instruction. Jabbari et al. (2012) found that PBL instruction had a positive relationship regarding students' preparation for future academic performance. Compared to lecture-based learning, the study established that PBL was a better preparatory mode of instruction to help students retain important information—not just for present use but for future utilization and application as well.

Summers and Dickinson (2012) determined the effects of PBL on the social studies learning experience. This study employed a randomized longitudinal design and explored students' experiences in a PBL high school compared to a conventional high school within the same rural district. Regular classroom observations were conducted in both of the selected schools to ascertain that they were following a prescribed curriculum. Results revealed that high school students experienced gains within 1 year because of PBL. Not only did PBL students outperform students from a traditional curriculum, they were also more prepared for college and career (Summer & Dickinson, 2012).

Criticism of PBL. Not all researchers have fully supported the use and implementation of PBL in academic settings. Marya (2011) found significant differences in the success between students studying the renal system who were evaluated based on comprehension, reasoning, and participation. They were evaluated objectively using the questionnaires administered to them at the end of their PBL lessons. The findings of the study led Marya (2011) to posit that more research must be conducted regarding the

appropriateness of using PBL for certain topics. Based on the findings, for example, it seemed that PBL only worked in order to improve student participation and engagement in class; however, it was unable to improve their retention of specific pieces of information, which were necessary for students of medicine. The researcher argued that automatically using PBL, upon the recommendation of previous studies and without first verifying its ability to augment the learning of a particular kind of knowledge, might lead to a false sense that students are learning what they should, when, in fact, they retained very little of what was required of them to know and understand. Marya reiterated that PBL may be very useful for teaching some disciplines but not for others, such as medicine.

Unlike, Marya (2011), Lou et al. (2011) did not propose that PBL might be inappropriate for the teaching of certain topics or for application in certain fields. However, the researchers did emphasize that PBL, on its own, may not be the only determinant to student success. The researchers showed that certain variables inherent in the students themselves, such as attitudes and behavior, can sometimes modify the outcomes of PBL, and therefore, these variables must be taken into consideration when studying the outcomes of student performance and achievement.

Researchers noted important limitations on the supposed effects of PBL, especially with respect to clinical education and group dynamics. According to Skinner, Braunack-Mayer, and Winning (2015), very few students acknowledged the usefulness of PBL as a group process in generating information and knowledge. Most participants valued PBL simply as a way for students to exchange information with one another and not as a means for students to collaborate and construct knowledge together.

Furthermore, the success of PBL often depended upon whether or not the students in the small sample were ready to work in groups or to acknowledge that working in groups was useful in building knowledge and learning.

Campbell (2012) identified some very pragmatic limitations to the positive effects of PBL. The researcher conducted an observational study in order to understand how the process of PBL is actually implemented and why. Campbell observed a 10th-grade class of English language learners who received PBL instruction in the span of 3 months, gathering around 60 hours of information in the process. According to the researcher, one of the greatest limitations of PBL is that it limits the amount of time a student uses for direct information gathering and for knowledge acquisition. Campbell (2012) also noted that whenever PBL is used, time is spent on preparation, on direct instruction, and on engagement with other students. The first and last stages of PBL limit the amount of time students have for direct instruction, where, sometimes, much of the substance of a particular subject is found.

Summary and Conclusion

The literature review documents the education reforms that were initiated to improve student learning and achievement. The two key reforms are the No Child Left Behind Act (NCLB) and the Common Core State Standards. Despite repeated attempts at improving student achievements and learning outcomes, the reforms did not succeed in bringing the desired impact on the student learning experience. This necessitated exploration of alternative models of teaching such as PBL.

Given all of the findings established in the literature, there is much support for the positive effects of PBL on the academic outcomes of students. Research suggests that

project-based learning has the potential to impact students positively. However, studies have not identified whether or not the model affects college and career readiness among high school students. Moreover, the literature has not addressed how these effects on college and work readiness are created. Even though few studies showed that PBL can lead to increased levels of college and career readiness, there are not enough studies at present to conclude this relationship. More research should be done on this prospective relationship. Therefore, based on these findings and the assertions made by researchers, there is a need for further study of the effects of PBL on high school college-work readiness, using methods that will validly quantify these constructs and relationships. This study investigated whether project-based learning impacts students' connection to their high school, learning experiences, and preparation for college and careers.

Few studies examined project-based learning in high school students, and no studies were found that examined project-based learning specifically in an alternative high school. Therefore, this study fills that gap and adds to our understanding of students' perceptions of project-based learning. Many scholars have noted that additional research is needed on project-based learning. Finally, empirical research has reinforced the value of further study.

Chapter 3 focuses on the research design methodology of this quantitative study. The chapter also explains the survey instrument, study participants, and the statistical MANOVA analysis employed for this study.

Chapter 3: Research Design Methodology

General Perspective

According to Eskrootchi and Oskrochi (2010), previous researchers have established that the main function of education is to transfer knowledge to learners. Traditionally, within formal school settings, this transfer of knowledge occurred through a process of an instructor supplying all of the information required by the students, and the students memorizing the given information. However, through academic and scientific inquiry, educators and academics began to realize that this traditional mode of knowledge transfer was not sufficient to meet the needs of all students. Eskrootchi and Oskrochi noted that many educators believe that in order for knowledge transfer to occur and for students to achieve stated learning outcomes, they must have real-life experiences that echo the skills and situations they will face in the future. Specifically, students, educators, and academics have agreed that teaching students by exposing them to projects that echo real-life situations and skills is one of the most effective means of achieving knowledge transfer (Eskrootchi & Oskrochi, 2010). This study is, therefore, timely and essential, possibly showing how PBL can lead to better student engagement and learning experience.

Research Context

The research took place within the OCM BOCES by the Assistant Superintendent of OCM BOCES and the Student Support Leadership Team (SSLT). The researcher is the District Superintendent of Schools of the Onondaga-Cortland-Madison county schools

and the Chief Executive Officer of the Board of the BOCES. The researcher's position as Superintendent had the potential to impact the study. Participants were made to understand that their honest responses bore no risks.

The population for this study included approximately 120 students from each school in Grades 9-11 from two alternative public high schools in Onondaga County. The alternative high schools were in the OCM BOCES district. Each school had nine teachers, one guidance counselor, and one social worker. Each building was supervised by one building principal.

One high school used traditional scheduling and teaching approaches, while the other high school had implemented project-based learning across all course disciplines. Prior to 2013, the latter school utilized traditional scheduling and teaching approaches. Students and their families decide in which district high school each student will enroll. The decision is typically based on geographical proximity to their homes. However, it was possible that some students and their families self-selected the project-based learning high school due to the PBL approach.

Research Participants

The population of this study included two groups of high school students. One group of students were immersed in a PBL program in their school, and the other group of students did not have a PBL program in their school. Every student in the two schools were exposed to the same curriculum throughout the duration of the research. This model made for a more logical comparison of the two schools. Students enrolled in the high schools were from Onondaga County, Grades 9-11, and ranged in age from

approximately 13 to 19-years old. Table 3.1 shows the breakdown of the student demographic data.

Table 3.1

Student Demographic Breakdown

Grade	Gender	School	
		PBL	Traditional
9	M	22	22
	F	11	10
Sub Total		33	32
10	M	25	25
	F	15	20
Sub Total		40	45
11	M	26	25
	F	20	21
Sub Total		46	46
Total		119	123

Instrument Used in Data Collection

The main instrument for the study was a survey questionnaire. Likert-type questions were utilized to assess the respondents' attitudes about specific questions or statements. The survey instrument for the study was the New Tech Network (NTN) Student Climate Survey (Appendix A). Permission to use the NTN Climate survey is in Appendix B. OCM BOCES administered the survey. NTN created the survey in 2015, and it comprises 27 Likert-scale questions, and eight multiple-choice items with ordinal statements. The NTN Student Climate Survey (NTN SCS) was developed, over time,

with input from school practitioners. It measures six dimensions: (a) school connectedness, (b) learning experiences through PBL, (c) fair and enforced discipline, (d) peer relationships, (e) adult relationships, and (f) college and career readiness. The survey took each student approximately 20 minutes to complete.

Validity and reliability. Validity is ensured if an instrument measures what it is designed to measure and achieves its purpose (Patten & Randall, 2009). According to Patten and Randall (2009), even though no survey instrument can be considered perfectly valid, researchers still need to make sure that the instrument they use leads to accurate conclusions. Validity, therefore, includes how appropriate, meaningful, and useful the researcher makes the inferences with the use of the instrument (Wallen & Fraenkel, 2001). Patten and Randall (2009) described content validity as the judgments made with regard to the appropriateness of an instrument's content. Further, the long-term use of previous versions of the instrument provides evidence of face validity, given that validity is defined as the degree to which a survey seems to measure what it reports to measure (Allen & Yen, 1979).

Test reliability refers to the degree to which a test is consistent and stable in measuring what it is intended to measure (Wallen & Fraenkel, 2001). The NTN Student Climate Survey is a reliable tool for measuring school culture as defined by NTN. An overall high Cronbach's Alpha score ($r = .930$) indicates that there is sufficient inter-item reliability because the alpha is higher than .80. Spearman-Brown's score ($r = .839$) indicates that it has sufficient split-half reliability (NTN, 2013). Table 3.2 shows how the survey questions align with sub-constructs.

Table 3.2

Constructs of School Climate Survey

Sub-Constructs	Student Climate Survey Questions
Informational	#4 – Counting this school year as 1, how many years have you attended this school?
	#5 – What grade are you in?
	#6 – What is your gender?
	#7 – What is your race?
School Connectedness	#13 – Which of the following statements best describe how proud you are of your school?
	13a – I contribute positively to my school.
	13b – I have been recognized for something positive at my school.
	13c – I take on leadership roles in my school.
	13d – I receive a high quality education at this school.
	13e – I am encouraged to be a strong learner at school.
Problem Solving	#15 – How often do the projects in your classes provide you with the opportunity to:
	15a – Feel excited about the work.
	15b – Allow me to be creative and innovative.
	15c – Present to an audience other than students and teachers.
	15e – Talk with experts and community members about my ideas to solve problems.
	15f – Learn the skills to successfully complete projects.
	#16 – How much do you agree or disagree with the following statements about working with other students?
	16a – I usually work in groups in my classes?
	16b – I have learned how to work well with others.
	16c – Students in groups share responsibility for the work.
	16d – Students in groups communicate respectfully.
College & Career Ready	#29 – How ready do you feel for each of the following?
	29a – Getting a job.
	29b – Applying for college.
	29c – Obtaining financial aid for college.
	29d – Taking classes at a community college.
	29e – Enrolling in a 4-year college.
	29f – Success in college.
	#30 – How much do you agree or disagree with the following statements about how well your school prepares students for life after high school?
	30a – School staff talk with students about options after high school.
	30b – School staff teach job hunting skills.
	31c – School staff help with college applications.
	30d – School staff provide information about what is required to be accepted at the college of my choice.

Procedures for Data Collection and Analysis

The researcher obtained permission (Appendix C) from OCM BOCES to utilize the data from the NTN Student Climate Survey. This was used as the secondary data.

OCM BOCES created and delivered the surveys using the SurveyMonkey online software. The data was aggregated, thus ensuring participant confidentiality. OCM BOCES teachers from both schools administered the online survey. OCM BOCES Assistant Superintendent of Student Support Services oversaw the survey. The district superintendent was not involved in the process. The survey was administered the last 2 weeks of January 2016, which is when the semester ends. The assistant superintendent provided two survey links, one for each school, which was sent to the school principals for distribution via the students' school-based email accounts. In addition, the assistant superintendent requested that each teacher assigned to the students set aside a specific time during the 2-week survey window. A second reminder was sent after week one.

PBL schools are designed with one-on-one technology as a core principle, which means that each student has a personal computer that has Internet access. The students within the traditional high school had the daily availability use of a computer in a computer room within their building. The steps described above ensured that every student had the opportunity to complete the survey on a laptop or in a computer room.

Data Analysis

The researcher obtained the raw data from OCM BOCES and imported that data into a statistical package. Data from SurveyMonkey, therefore, was exported to the Statistical Package for the Social Sciences (SPSS) v22.0, where the analysis took place. This study presented descriptive and inferential data on the relationship between PBL and

students' connectedness to their school and their perceptions of learning and their perceptions of their college and career readiness.

In order to answer the three research questions, the researcher standardized the scores in each construct and conducted a multivariate one-way analysis of variance (MANOVA). MANOVA is an analysis of variation (ANOVA) with several dependent variables. ANOVA tests for the difference in the means between two or more groups, while MANOVA tests for the difference in two or more vectors of means. For this study, there were three dependent variables, making the analysis method appropriate. The independent variable was PBL, and the dependent variables were the students' connectedness to their schools, their perceptions of learning, and their perceptions of their college and career readiness. A MANOVA allowed for the comparison of the constructs of interest between the PBL and the non-PBL high school.

The study took a *p*-value approach to hypothesis testing. The *p*-value approach determines whether it is likely or unlikely to be able to observe a more rigorous statistic test (assuming the null hypothesis is true) in proving the alternative hypothesis. If the selected *p* -value was less than or equal to the significance level (α), then the null hypothesis was rejected in favor of the alternative hypothesis. If the selected *p*-value was more than α, then the null hypothesis was not to be rejected. In this study, the significance level (α) was set at 0.05. This means that if the *p* -value was less than or equal to 0.05, then the null hypothesis was rejected in favor of the alternative hypothesis. This signifies that there was a less than 5% chance that the test results in the study were obtained by random chance or error.

Summary

Research suggests that project-based learning has the potential to impact students positively. Few studies have examined project-based learning in high school students, and no studies were found that examined project-based learning specifically in an alternative high school. Therefore, this study should fill that gap and add to our understanding of students' perceptions of project-based learning. This study investigated whether project-based learning impacted students' connections to their high schools, learning experiences, and preparation for college and careers.

Utilizing the data collection by OCM BOCES, the researcher used descriptive and inferential statistics to answer the three research questions. Analysis of the data in relation to each question shed light on the relationship between PBL and students' connectedness to their schools, their perceptions of learning, and their perceptions of their college and career readiness. Chapter 4 reports the statistically analyzed data collected for this study and summarizes the findings.

Chapter 4: Results

This chapter presents the results of the quantitative study that examined whether students engaged in project-based learning reported different experiences and outcomes compared to students who were not engaged in project-based learning. The analysis of data included 2016 archival data from the participating regional educational agency, OCM BOCES. The main instrument for the study was a survey questionnaire. Likert-type questions were utilized to assess respondents' attitudes about a specific question or statement. The survey instrument for this study was the NTN Student Climate Survey (Appendix A). OCM BOCES administered the survey in January 2016. NTN created the survey in 2014, and it comprises 27 Likert-scale questions, and eight multiple-choice items with ordinal statements. The NTN Student Climate Survey has been developed over time with input from school practitioners. It measures six dimensions: (a) school connectedness, (b) learning experiences through PBL, (c) fair and enforced discipline, (d) peer relationships, (e) adult relationships, and (f) college and career readiness. The survey took each student approximately 20 minutes to complete.

The specific research questions and hypothesis, the demographics, the data collection process, and the response rates are outlined in the research question section. The data analysis section reviews the research variables and the analytic approach taken.

Research Questions

Data analysis and findings regarding the research problem, research questions, and hypothesis were presented in the previous chapters. The research problem was

answered based on the data analysis. After several attempts at educational reform, student achievement has not increased, and students are falling short in terms of college and career readiness (Stone-Johnson, 2015). Traditional teaching methods have not yielded the intended results (Roderick et al., 2009). Alternate teaching methods, such as project-based learning, have the potential to enhance student engagement, learning experiences, and college and career readiness. In this study, PBL is examined as a viable alternative to traditional teaching methods and classroom environments. It determined if PBL effects can better assist in the preparation for college and career for high school students. In order to explore whether the students engaged in project-based learning reported different experiences and outcomes compared to the students who were not engaged in project-based learning, these questions guided the research study:

1. In comparison to students who do not participate in project-based learning, to what extent do high school students who participate in project-based learning report a greater connection to their school?
2. In comparison to students who do not participate in project-based learning, to what extent do high school students who participate in project-based learning report working better with others to solve problems?
3. In comparison to students who do not participate in project-based learning, to what extent do high school students who participate in project-based learning report that they are better prepared for college and career?

At a significance level of $p < 0.05$, the study goal was to determine if secondary students reported different experiences and outcomes compared to students who were not

engaged in project-based learning. Data from the NTN Student Climate self-reporting assessment provided the results and evidence necessary to answer the research questions.

Data Analysis and Findings

Inferential statistics were used to draw conclusions from the sample tested. The SPSS v22.0 was used to code and tabulate the scores collected from the survey and provide summarized values, where applicable, including the mean, central tendency, variance, and standard deviation. A MANOVA was used to evaluate the three research questions.

Prior to analyzing the research questions, data cleaning and data screening were undertaken to ensure the variables of interest met appropriate statistical assumptions. Thus, the following analyses were assessed using an analytic strategy in that the variables were first evaluated for missing data, univariate and multivariate outliers, normality, homogeneity of variance, homogeneity of variance-covariance matrices, and multicollinearity. Finally, the MANOVA analysis was run to test the three research questions. The MANOVA equation is:

$$\sum_{\square}\sum_{\square}(\square_{\square\square} - \square\square)^2 = \square\sum_{\square}(\bar{Y}_{\square} - \square\square)^2 + \sum_{\square}\sum_{\square}(\square_{\square\square} - \bar{Y}_{\square})^2$$

Demographics. Data were collected from a sample of 153 high school students in Onondaga County. However, 33 students did not respond to four or more of the survey items that measured the dependent variables. Thus, the 33 cases were removed from all analyses. Therefore, a valid sample of 120 high students was used to evaluate the three research questions. Specifically, 58.3% of the students were male (n = 70), 40.8%, were female (n = 49), and one participant did not provide his or her gender. Additionally, the

majority of the participants were White (74.2%, *n* = 89), 10.8% were multi-racial (*n* = 13), 6.7% were African American (*n* = 8), and 2.5% were Hispanic (*n* = 3). Finally, one participant was American Indian (0.8%), five participants were of other races (4.2%), and one participant did not provide his or her racial identity (0.8%). Frequency and the percent statistics of participants' gender and race are displayed in Table 4.1.

Additionally, 36 of the 120 participants (30.0%) were in the ninth grade, 41 were in the 10th grade (34.2%), 40 were in the 11th grade (33.3%), and three were in the 12th grade (2.5%). Of the participants, 34.2% attended 1 year of schooling of (*n* = 41), 25.0% had 2 years of school experience (*n* = 30), and 7.5% had 3 years of school experience.

Table 4.1

Cross Tabulation of Participants' Gender and Race

Demographic	Frequency (*n*)	Percent (%)
Gender		
Male	70	58.3
Female	49	40.8
Missing	1	0.8
Total	120	100.0
Race		
American Indian	1	0.8
African American	8	6.7
Hispanic	3	2.5
White (non-Hispanic)	89	74.2
Multi-racial	13	10.8
Other	5	4.2
Missing	1	0.8
Total	120	100.0

Note. Total *N* = 120

Finally, two participants had attended high school for 4 years (1.7%), one had attended high school for 5 years (0.8%), one had attended school for 8 years (0.8%), and 36 participants did not respond to the survey question (30.0%). Displayed in Table 4.2 are

participants' grade level and years of attendance, and Table 4.3 shows the frequency and percent statistics of the parents' highest level of education.

Table 4.2

Frequency and Percent Statistics of Participants' Grade Level and Years of Attendance at Current School

Demographic	Frequency (*n*)	Percent (%)
Grade Level		
9th grade	36	30.0
10th grade	41	34.2
11th grade	40	33.3
12th grade	3	2.5
Total	120	100.0

Note. Total $N = 120$

Table 4.3

Frequency and Percent Statistics of the Parents' Highest Level of Education

Parent's Highest Level of Education	Frequency (n)	Percent (%)
Did not graduate high school	21	17.5
High school graduate	23	19.2
Some college	15	12.5
Certificate program	7	5.8
AA or Associate Program	11	9.2
BA or Bachelor Program	10	8.3
Graduate or Professional Degree	7	5.8
Do not know	26	21.7
Total	120	100.0

Note. Total $N = 120$

Analysis of research questions 1-3. Research questions 1-3 were evaluated using a MANOVA analysis to determine if any significant differences in high school student's

school connectedness, ability to work with others to solve problems (problem-solving skills), and college and career readiness between those that participate in project-based learning and those that do not participate. Specifically, the dependent variable for research question 1 was students' school connectedness scores as measured by six items (questions #6, 9a, 9b, 9c, 9d, and 9e) on the NTN-SCS. The dependent variable for research question 2 was the students' ability to work with others (learning) scores as measured by 10 items in the NTN-SCS (questions #10a, 10b, 10c, 10d, 10e, 10f, 11a, 11b, 11c, and 11d). The dependent variable for research question 3 was students' college and career readiness scores as measured by 10 items on the NTN-SCS (questions #20a, 20b, 20c, 20d, 20e, 20f, 21a, 21b, 21c, and 21d). Response parameters were measured on a 5-point Likert-type scale where 1 = *strongly disagree*, 2 = *disagree*, 3 = *neither agree nor disagree*, 4 = *agree*, and 5 = *strongly agree.* Composite scores were calculated for each dependent variable by averaging case scores across the constructs' items, resulting in a possible range of scores between 1 and 5, that is, higher scores indicated greater levels of school connectedness, learning to work with others, and college and career readiness. The composite scores were used as the dependent variables to evaluate research questions 1-3. The independent variable for research questions 1-3 was the school that each student attended: Innovation Tech (PBL school) and the STARS Program (non-PBL school).

Data cleaning. Data was collected from a valid sample of 120 high school students. Before the data were evaluated, they were screened for missing data, univariate outliers, and multivariate outliers. Missing data were investigated using frequency counts, and several cases did not respond to between one and three survey questions. To retain as

many participants as possible, the missing scores were replaced with the survey items' series mean score. Thus, 120 high school students were used to evaluate research questions 1-3.

The data was screened for univariate outliers by transforming raw scores to z-scores and comparing z-scores to a critical range between –3.29 and +3.29, $p < .001$ (Tabachnick & Fidell, 2007). Z-scores that exceed this critical range are more than three standard deviations away from the mean, and thus, they represent outliers. The distributions were evaluated, and there were no cases with univariate outliers.

Multivariate outliers were evaluated using Mahalanobis distances. The Mahalanobis distances were computed for each variable, and these scores were compared to a critical value from the chi square distribution table. The results indicated that one case within the distributions was found to exceed the critical value, and it was removed from the analysis. Thus, 120 valid responses from participants were received and 119 were evaluated by the MANOVA model for research questions 1-3 ($N = 119$). Descriptive statistics of the participants' school connectedness, learning, and college and career readiness scores are displayed in Table 4.4 by schools of attendance, which are Innovation Tech and the STARS program.

Reliability analysis. A reliability analysis was run to determine if the three dependent variables (school connectedness, problem-solving skills, and college and career ready) were sufficiently reliable. Reliability analysis allows one to study the properties of measurement scales and the items that compose the scales (Tabachnick & Fidell, 2007). Cronbach's alpha (α) reliability analysis procedure calculates a reliability coefficient that ranges between 0 and 1. The reliability coefficient is based on the

Table 4.4

Descriptive Statistics of Participants' School Connectedness, Learning, and College and Career Readiness Scores by Schools of Attendance

Variable	*n*	Min	Max	Mean	Std. Deviation	Skewness	Kurtosis
Innovation Tech (PBL school)							
Connectedness	72	1.000	3.830	2.924	0.635	–1.092	1.562
Problem Solving	72	1.000	4.000	2.765	0.640	–0.190	0.897
College & Career Ready	72	1.000	4.400	2.850	0.912	–0.159	–0.530
STARS Program (non-PBL school)							
Connectedness	47	1.670	3.500	2.582	0.439	0.027	–0.128
Problem Solving	47	1.000	3.600	2.266	0.546	–0.013	–0.138
College & Career Ready	47	1.000	4.400	2.755	0.822	–0.032	–0.430

Note. Total $N = 119$

average inter-item correlation. Scale reliability is assumed if the coefficient is $\alpha \geq .70$. Results from the tests found that all variable constructs were sufficiently reliable ($\alpha > .70$). Thus, the assumption of reliability was not violated. Table 4.5 displays the summary statistics of the reliability analyses conducted on the three dependent variables.

Normality. Before the research questions were analyzed, basic parametric assumptions were assessed. That is, for the dependent variables (school connectedness, problem-solving skills, and college and career ready) assumptions of normality, homogeneity of variance, homogeneity of variance-covariance matrices, and

Table 4.5

Summary of Reliability Analyses Conducted on the Three Dependent Variables

Dependent Variable	# of Items	Cronbach's Alpha (α)
School Connectedness	6	0.818
Problem Solving	10	0.891
College and Career Ready	10	0.919

Note. Total $N = 119$

multicollinearity were tested. To test if the distributions were normally distributed, the skew and kurtosis coefficients were divided by the skew/kurtosis standard errors, resulting in z-skew/z-kurtosis coefficients. This technique was recommended by Tabachnick and Fidell (2007). Specifically, *z*-skew/z-kurtosis coefficients exceeding the critical range between –3.29 and +3.29 ($p < .001$) can indicate non-normality. Thus, based on the evaluation of the z-skew/z-kurtosis coefficients, one distribution was found to be significantly skewed (Innovation Tech – school connectedness *skew* = –1.092, *z-skew* = –3.859). Although the distribution violated the assumption of normality, Tabachnick and Fidell (2007) posited that the MANOVA model is robust against modest violations of normality. Therefore, no actions were taken, and the violation was considered a limitation of the study. For the remaining distributions, the assumption of normality was not violated and the distributions were assumed to be normally distributed. Skewness and kurtosis statistics of the dependent variables for research questions 1-3 are displayed in Table 4.6.

Homogeneity of variance. Levene's Test of Equality of Error Variance was run to determine if the error variances of the dependent variables (study school connectedness,

problem-solving skills, and college and career ready) were equal across levels of the independent variable, which was Innovation Tech and the STARS program. The results indicated that no distributions violated the assumption of homogeneity of variance ($p >$ .05). These results suggest that the error variances were equally distributed across the two levels of the independent variable, which was Innovation Tech and the STARS program. Table 4.7 displays the summary details of the Levene's test for research questions 1-3.

Homogeneity of variance-covariance matrices. To examine the assumption of the homogeneity of variance-covariance matrices, Box's M Test of Equality of Covariance Matrices was conducted. The test was run to determine if the distributions of the dependent variables (school connectedness, problem-solving skills, and college and career ready) were equal across the levels of the independent variable (Innovation Tech, the STARS program). The critical value determining violation of the assumption is $p <$ .001. Results from the test found that the distributions were equal across the dependent variables, *Box's M* = 13.448, F (6, 64863.484) = 2.175, and p = .042. Therefore, the assumption of homogeneity of variance-covariance matrices was not violated.

Table 4.6

Skewness and Kurtosis Statistics of Participants' School Connectedness, Problem-solving Skills, and College and Career Readiness Scores by Schools of Attendance

Variable	*N*	Skewness	Skew Std. Error	z-skew	Kurtosis	Kurtosis Std. Error	z-kurtosis
Innovation Tech (PBL school)							
School Connectedness	72	–1.092	0.283	–3.859	1.562	0.559	2.794
Problem Solving	72	–0.190	0.283	–0.671	0.897	0.559	1.605
College & Career Ready	72	–0.159	0.283	–0.562	–0.530	0.559	–0.948
STARS Program (non-PBL school)							
School Connectedness	47	0.027	0.347	0.078	–0.128	0.681	–0.188
Problem Solving	47	–0.013	0.347	–0.037	–0.138	0.681	–0.203
College & Career Ready	47	–0.032	0.347	–0.092	–0.430	0.681	–0.631

Note. Total $N = 119$

Table 4.7

Summary of Levene's Tests for Research Questions 1-3

Dependent Variable	F	df1	df2	Sig. (*p*)
School Connectedness	3.614	1	117	.060
Problem Solving	0.196	1	117	.659
College & Career Ready	0.759	1	117	.385

Note. Total $N = 119$

Multicollinearity. The assumption of multicollinearity was tested by calculating correlations between the dependent variables (school connectedness, problem solving, and college and career ready) using collinearity statistics (correlations, tolerance, and variance inflation factor). Correlations between the dependent variables did not exceed .80. Additionally, the tolerance was calculated using the formula T = 1 – R2, and the variance inflation factor (VIF) was the inverse of Tolerance (1 divided by T). Commonly used cut-off points for determining the presence of multicollinearity are T < .10 and VIF > 10. The results indicated that the tolerance and VIF coefficients did not exceed the critical values. Therefore, the presence of multicollinearity was not assumed. Table 4.8 displays the summary statistics of the correlation analysis conducted to test the assumption of multicollinearity.

Results of hypothesis 1. Null Hypothesis 1 ($H1_0$). There is no significant difference in high school students' school connectedness between those who participate in project-based learning and those who do not participate.

Table 4.8

Correlations Between Dependent Variables

Dependent Variable	School Connectedness	Problem Solving	College & Career Ready
School Connectedness	1.000	0.703	0.463
Problem Solving		1.000	–0.217
College & Career Ready			1.000

Note. Total $N = 119$

Alternative hypothesis 1 ($H1_A$). There is a significant difference in high school students' school connectedness between those who participate in project-based learning and those who do not participate.

Null hypothesis 2 ($H2_0$). There is no significant difference in high school students' ability to work with others to solve problems between those who participate in project-based learning and those who do not participate.

Alternative hypothesis 2 ($H2_A$). There is a significant difference in high school students' ability to work with others to solve problems between those who participate in project-based learning and those who do not participate.

Null hypothesis 3 ($H3_0$). There is no significant difference in high school students' college and career readiness between those who participate in project-based learning and those who do not participate.

Alternative hypothesis 3 ($H3_A$). There is a significant difference in high school students' college and career readiness between those who participate in project-based learning and those that who not participate.

Using SPSS v22.0, a MANOVA was used to determine if there were any significant differences in high school student's school connectedness, ability to work with others to solve problems, and college and career readiness between those who participate in project-based learning and those who do not participate. Results indicate that there were no significant multivariate differences between schools of attendance on a model containing the three dependent variables (school connectedness, learning, and college and career ready). Table 4.9 displays the summary statistics of the MANOVA analysis.

Table 4.9

Summary of MANOVA Analysis for Hypotheses 1-3

Effect	Wilk's Lambda	F	Hypothesis df	Error df	Sig. (*p*)	Partial Eta Squared
Intercept	0.038	968.489	3	115	<.001	0.962
School of Attendance	0.817	8.612	3	115	<.001	0.183

Note. Dependent variables = school connectedness, problem solving, and college and career ready; Total $N = 119$

Results from the tests of between-subject effects indicated there were individual significant differences in two of the three dependent variables between schools of attendance (school connectedness $p. = .002$ and problem solving $p. < .001$). For the participants' college and career readiness scores, no significant differences were found between schools. Thus, the null hypotheses for research questions 1 and 2 were rejected in favor of the alternative hypotheses. The null hypothesis for research question 3 was retained. A model summary of the individual tests of between-subject effects is displayed in Table 4.10.

Table 4.10

Model Summary of the Tests of Between-Subject Effects for Hypotheses 1-3

Source	Type III Sum of Squares	df	Mean Square	F	Sig. (*p*)	Partial Eta Squared
Corrected Model						
School Connectedness	3.327	1	3.327	10.366	0.002	0.081
Learning	7.090	1	7.090	19.396	<.001	0.142
College & Career Ready	0.255	1	0.255	0.331	0.566	0.003
Intercept						
School Connectedness	861.837	1	861.837	2685.600	<.001	0.958
Learning	719.834	1	719.834	1969.211	<.001	0.944
College & Career Ready	893.478	1	893.478	1159.767	<.001	0.908
School of Attendance						
School Connectedness	3.327	1	3.327	10.366	0.002	0.081
Learning	7.090	1	7.090	19.396	<.001	0.142
College & Career Ready	0.255	1	0.255	0.331	0.566	0.003
School Connectedness	37.547	117	0.321			
Learning	42.769	117	0.366			
College & Career Ready	90.136	117	0.770			
Total						
School Connectedness	966.194	119				
Learning	834.660	119				
College & Career Ready	1031.770	119				
Corrected Total						
School Connectedness	40.873	118				
Learning	49.859	118				
College & Career Ready	90.391	118				

Note. Total $N = 119$.

Figure 4.1 displays the significant differences in the participants' school connectedness and problem-solving scores, that is, students who attended Innovation Tech had significantly higher connectedness scores ($M = 2.924$, $SD = 0.635$) compared to participants who attended the STARS program ($M = 2.582$, $SD = 0.439$). Similarly, participants who attended Innovation Tech had significantly higher learning scores ($M = 2.765$, $SD = 0.640$) compared to participants who attended the STARS program ($M = 2.266$, $SD = 0.546$). Conversely, results indicated that students who attended Innovation Tech had statistically similar college and career readiness scores ($M = 2.850$, $SD = 0.912$) compared to those who attended the STARS program ($M = 2.755$,

SD = 0.822). A means plots of the three dependent variables by schools of attendance are displayed in Figure 4.1.

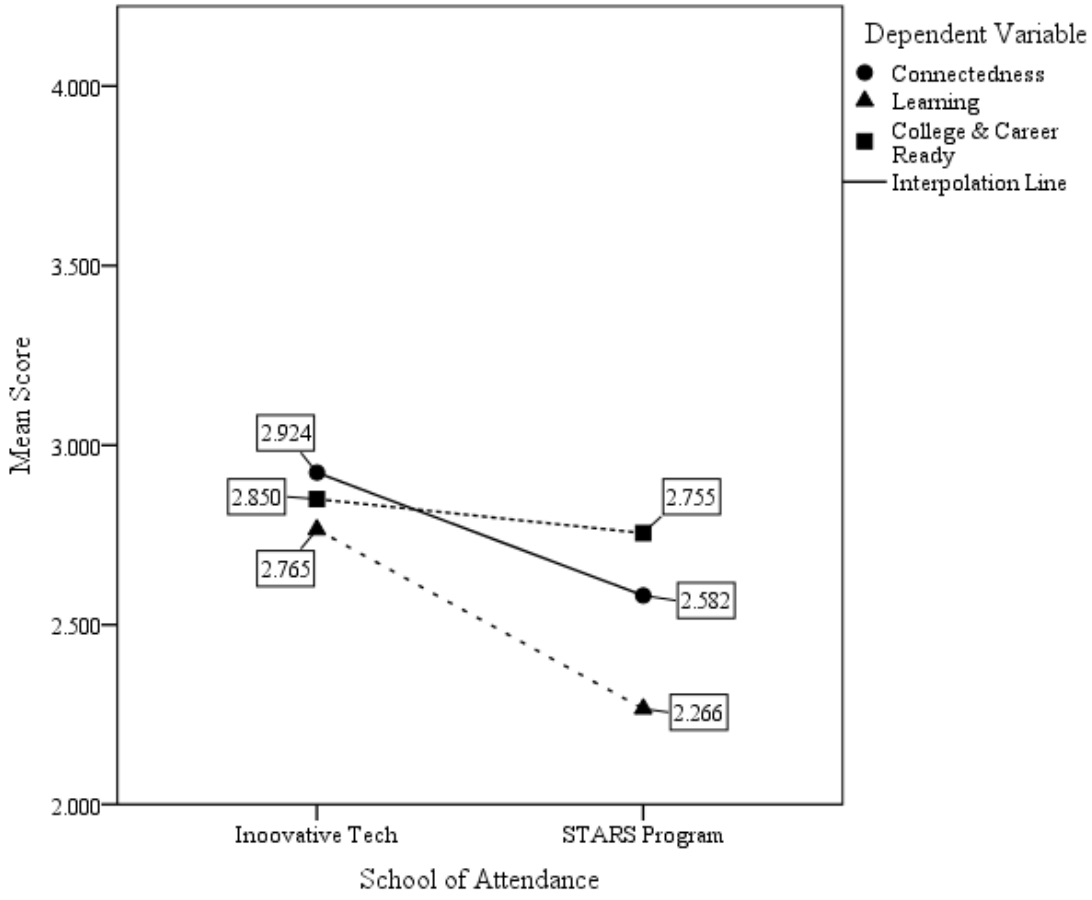

Figure 4.1. Means plot of the participants' connectedness, problem-solving skills, and college and career readiness scores by schools of attendance.

Summary of Results

The study for this sample consisted of 153 students in Onondaga County, divided roughly evenly between Innovation Tech (PBL school) and STARS (non-PBL school), where 33 students failed to answer four or more of the survey questions. Those 33

Table 4.11

Summary of Results for Hypotheses 1-3

Hypothesis	Dependent Variable	Independent Variable	Analysis	Sig. (*p*)
H1	School Connectedness	School of Attendance	MANOVA	0.002
H2	Problem-Solving Skills	School of Attendance	MANOVA	<.001
H3	College and Career Ready	School of Attendance	MANOVA	0.566

Note. Total $N = 119$

students were removed from the study (as per the default of SPSS), and the analysis was confined to those who actually filled out the survey in either its entirety, or near entirety. Chapter 4 presented the results of a one-way MANOVA analysis of the two groups of students who participated in the survey. In particular, three research questions were posed, and based on the MANOVA results, expressed by the Wilk's lambda, the first two questions suggest PBL was more effective than traditional learning method, whereas in the third case, PBL was approximately equivalent to traditional methods.

Chapter 5 summarizes this entire study and includes the implications of findings and limitations of the study while discussing recommendations for actions and further research.

Chapter 5: Discussion

Introduction

In this research study, project-based learning is explored and studied as an instructional model that embraces the theoretical framework of experiential learning theory. The research literature reviewed in Chapter 2 suggests PBL is an effective alternative to traditional instructional techniques, and it may be responsive to the demands of 21st century learning for students (Mergendoller et al., 2006; Prosser & Sze, 2014).

This chapter focuses on the reported results from students who were attending Innovated Tech, an OCM BOCES alternative school that uses PBL as an instructional model, as well as students who were attending the STARS program, an OCM BOCES alternative school that uses traditional instructional models.

After a comprehensive review of the literature, there were few studies found that specifically address PBL with high school students, and there were no studies found that examined PBL in an alternative high school setting. The implications of the research findings in this quasi-experimental study will have significant and positive impact on the learning experiences of students attending alternative high schools, and they will likely offer program design possibilities for educators. In this chapter, the statistical results and implications of the findings are discussed, as well as consideration of the study's limitations and recommendations for further research.

Implications of Findings

This research study has implications for a variety of school stakeholders. The research questions examine the PBL model as a pedagogy that allows for students to increase 21st century knowledge and skills by solving complex problems and challenges. Within this model, students are guided through inquiry, research, and responses throughout an extended period of time. The implications of this research study that measure student responses to school connectedness, problem solving, and career and college readiness are explored in this section.

School connectedness. The first finding of this research study was developed through the investigation of research question 1: In comparison to students who do not participate in project-based learning, to what extent do high school students who participate in project-based learning report working better with others to solve problems? The analysis showed that the students at Innovation Tech reported higher scores on school connectedness than the students attending the STARS program.

As the survey questions measured, school connectedness included six elements. Positive responses to the study's survey questions on school connectedness included students being proud of their school, liking their school better than others, and being recognized for something positive at their school. Being accepted for "who I am," being praised for their efforts, and being encouraged to be stronger leaders at school were additional school connectedness responses.

The implication of the result of research question 1 suggests that an alternative high school that implements the PBL model may increase students' perceptions of school connectedness. This connection may be based, first, on a topic or project, and, second, by

developing a sense of belonging to the social community of the school, therefore, increasing their cognitive and emotional commitment to engage in school tasks and complete their studies. This implication supports the reviewed research that suggests there is improved student satisfaction levels and engagement levels, as well as an increase in students' self-efficacy and motivation, with students who learn within a PBL model of instruction (Bagheri et al., 2013; Bell, 2010; Holm, 2011; Palmer & Hall, 2011). The results of research question 1 imply that school connectedness is a positive result for students engaged in a PBL model. This inference may increase the likelihood that alternative high school students can achieve high academic standards and increase the probability of graduating.

Problem solving. The second finding of this research study was developed through the investigation of research question 2: In comparison to students who do not participate in project-based learning, to what extent do high school students who participate in project-based learning report working better with others to solve problems? The analysis showed that the students at Innovation Tech reported higher scores on problem solving than the students attending the STARS program.

Problem-solving responses from the survey instrument included students being able to learn skills to successfully complete their projects. The self-reporting of students included allowing students to be creative and innovative, learning to work well with others in groups, and sharing responsibility for the work. Other responses included the ability to communicate respectfully with one another, help their communities, be excited to do their work, and present to audiences other than students and teachers.

The result of research question 2 appear to support previous empirical research by Lou et al. (2011) that explored how PBL worked among high school students who were attempting to solve a series of problems using science, technology, and mathematics knowledge that they learned through PBL-based instruction. In addition, the findings support research that the students' practice of determining problems within a PBL program can lead to improved analysis and reasoning capabilities (Sockalingam & Schmidt, 2011). Adoption of the alternative hypothesis in this research implies that support for a PBL model may improve student's acquisition of the 21st century skill of problem solving.

Career and college readiness. The third finding of this research study was developed through the investigation of research question 3: In comparison to students who do not participate in project-based learning, to what extent do high school students who participate in project-based learning report that they are better prepared for college and career? The analysis showed that there was no statistical evidence that students at Innovation Tech reported a higher level of school connectedness than the students attending the STARS program.

To understand the survey responses for research question 3, career and college readiness, and an analysis was conducted on the students' perceived readiness as to their ability to plan and manage their tasks after attending an alternative high school graduation. Students' responses included preparing for getting a job, applying for and obtaining financial aid, and enrolling in college. Taking classes at a community college and experiencing success in college were also considered in their responses. The responses on interacting with school staff, specifically about student options after high

school, including job-hunting skills, help with college applications, and requirements for being accepted at a college of their choice, were also included to analyze research question 3.

The evidence from this study did not seem to affect how students reported being better prepared for college and career. The Chapter 2 reviewed research indicated that students scored higher and retained science information better 2 years after PBL instruction than students who had not received PBL instruction, (Jabbari et al., 2012). One implication might be that the knowledge and skills students learn through experiencing the PBL model may not show up for students until they actually start college or their careers. This implication may mean that students need more time to reflect on the effect of their PBL experiences before a positive change of perception on college and their career readiness can occur.

Limitations

This research study had four limitations that may have affected the potential impact of the study quality or the ability of this study to answer the research questions.

Research design. The first limitation may have been in the research design. For example, one of the differences between Innovation Tech (PBL school) and the STARS program (non-PBL school) is that students self-selected the school they wished to attend. This decision was made in collaboration and with guidance from others, such as counselors and parents, and there was no control over this difference in the research design.

Although the quasi-experimental design was an appropriate design for this study, given that generalizations can be implied, it was not a "true experiment," and therefore,

one cannot claim the study results are causal. Although both designs measure the research questions, a true experiment would have had the participants randomly assigned, and the factors that might affect the phenomenon would have been completely controlled. In this quasi-experimental design, it was not practical to control all of the key factors of the design. This limitation means the results could be interpreted in numerous ways. The implications of the results explored in this chapter correspond to the findings of the study's research questions and the review of previous literature; however, additional or competing hypotheses might be found given a different interpretation of the same findings.

Main instrument for data collection. A second limitation for this study was the instrument for data collection, the structured NTN Student Climate Survey. This survey, as with many survey instruments, places limits on the breadth and depth of the data gathered and, as such, these facts might have affected the results of the three research questions. In addition, as a relatively new instrument, there is a lack of empirical evidence from the New Tech Network to support this survey instrument.

Demographic of the sample size. The third limitation of the study was the demographic of the sample size and location. This study included a relatively small selection of study participants. The small sample size might have affected the extent to which the findings could be representative and generalized to other alternative high schools.

Demographic of the sample location. The fourth limitation of the study was the location demographic. The alternative high schools studied, Innovation Tech and the STARS program, are located in the Onondaga Cortland Madison BOCES located in

central New York State. The Onondaga Cortland Madison BOCES is one of 27 BOCES regions in New York State.

Recommendations

There are substantial recommendations for stakeholders of alternative high schools to contemplate as a result of the findings in this study. These recommendations include considerations that build and maintain a highly accountable, strategic culture for students through a PBL model school. There are strong recommendations for leaders, teachers, policy makers, and curriculum, as well as possibilities for future research. The first task for stakeholders is to agree upon what a PBL model school should look like. To create a PBL model school, educational leaders must lead a shared understanding between teachers and policy makers on the conceptual framework and current research that correlates the positive effects of PBL on high school students attending alternative high schools.

Creation of a PBL model. A PBL model school would create a culture that focuses on student learning goals that include standards-based content and skills. These elements would involve working with others in a collaborative setting and designing questions and projects that involve critical thinking and solving real problems. The model should include problems and questions that are challenging and meaningful to the students and their audience. Designing questions that sustain a process of student inquiry, as well as providing the opportunities to find resources and apply the information they discover are critical. The projects and challenges must relate to the student, and/or the world, in an authentic setting; and they can speak to personal concerns, community issues, and/or student interests. The Buck Institute for Education defines project

authenticity as, “real-world context, tasks and tools, quality standards, or impact – or speaks to students’ personal concerns, interests, and issues in their lives” (Larmer, Mergendoller, & Boss, 2015). The PBL model must include teaching students decision-making methods—not only for the resulting presentations, but also for the decisions regarding what to include and what not to include the things they have learned. The students should be taught to understand the meaningful experience of critical feedback and how the experience of feedback, reflection, and revision can strengthen the impact of their project. At last, the students should learn how to present their work publicly, to use field questions, and to summarize their results effectively.

Recommendations for leaders. When creating a shared understanding of a PBL model with other leaders and teachers in the school, school leadership teams should focus on, and encourage the positive results reported by students on improved school connectedness and working with others to solve problems. Leaders can create the conditions that will support a school-wide culture shift to PBL by developing a shared leadership structure. Leaders should lead a consensus of an agreed-upon model of PBL, along with the implementation of the model, which should be developed among the educators at each school.

Recommendations for teachers. The descriptive case study reported by Tamim and Grant (2013) indicated three themes that were significant experiences for teachers when applying PBL. The teachers were acutely aware of the benefits to students of the PBL model. Also, the teachers varied their use of PBL among one another and over time. The teachers adapted PBL methods in response to the needs of their students. An important understanding for teachers is that PBL is grounded in the students’

experiences. These experiences include the construction of knowledge perceived by the learners within a particular context. There is a need for teachers to understand and accept that PBL involves a change of pedagogy, given that students would be solving open-ended problems, and applying self-directed learning is critical.

Professional development. A significant shift in the perception of the role of the teacher is required for a PBL model. The leaders of an ongoing PBL professional development program can assist teachers to effectively use the PBL model to increase students' connectedness and problem-solving skills. Some objectives of such a program could include how PBL can reframe content standards and initiate and focus inquiry. Teachers should learn to develop and guide lesson planning to communicate the purpose of a project clearly to students. Professional development would be meaningful for teachers that features feedback loops, reflection for teachers and administrators, and guided lesson development to prepare students for the types of activities and social challenges that they will face in a PBL model. Teachers who receive ongoing training in how to use the PBL elements in instruction, such as developing challenging problems, sustaining inquiry, preparing students for critique and revisions, and to present their public product, will help them to achieve the goals of the PBL model. Additional professional development is needed so teachers can effectively incorporate appropriate assessments. such as rubrics. that specify formative growth. Summative assessments that include individual and group feedback should be included to complete the projects.

Teachers as researchers. In order to understand and commit to a learning culture around the PBL model, teachers could participate in action research projects that focus on PBL pedagogy. Teachers can collaboratively clarify theories, identify research questions,

collect and analyze data, and report their results as they learn. In order to understand and commit to the PBL model, teachers may begin with an action research project that focuses on PBL theory and/or practices. Teachers can collaboratively clarify theories, identify research questions, collect and analyze data, and report their results as they learn. This kind of in-depth study of the PBL model could create the clarity, motivation, and execution that teachers need to create an instructional culture for PBL.

***Recommendations for policy makers*.** Policy makers can positively influence the culture of PBL model schools by reviewing and revising local and state school policies.

Strategic planning. Recommendations for local school policymakers include the review and revision of school strategic plans to include a PBL model as a strategy for meeting-plan outcomes. Strategic plans define the culture a school needs to create in order to achieve the outcomes it wants for its students. It defines the school values, what the stakeholders believe in, and what they essentially want to provide for their students. A powerful mission, strategies, and outcomes are needed to support a PBL model school.

Teacher evaluation. A second recommendation for policy makers is to create and implement a teacher evaluation process that measures the instructional skills that increase the success of a PBL model. Principals are charged with the supervision of teachers in a school that is implementing a PBL model. Considering the working timelines needed for a PBL model and the possibility of teachers from differing content areas having to collaborate with each other, principals need a model of supervision and evaluation that can include combinations of clinical peer supervision, mentoring, and action research. Principals and supervisors should become advocates and facilitators of teacher growth

within the PBL model, and they should clearly define how the teachers' execution of the PBL model will be reflected in an evaluation process.

Principals will need to be more tolerant and willing to encourage risk taking in order to supervise PBL schoolteachers, and this should be reflected in the evaluation process. Principals assigned to PBL model schools must be good coaches and excellent communicators with their teachers. The desire for a valuable learning experience must outweigh the conflict they may experience when trying to exert too much control over traditional school management structures.

Additional school policies that might be considered are those that define specific PBL curriculum and professional development for the school. A policy that includes contributions from members of the school community would be helpful so those people can become involved in the planning, implementation, and results of a PBL model. Policy makers will also need to review and rewrite operational policies that support strategies for the PBL model, particularly in the area of technology, facilities planning, and fiscal decisions.

Recommendations for curriculum. When curriculum leaders are considering the implementation of a PBL model, and they want to increase the strength and ultimate success of the design, strategies should be developed that include some of the implications from previous research. The research of Boaler (2002), Carney-Strahler (2011), and Lou et al. (2011), indicated improved learning in STEM courses supports a cross-curricular development of PBL. Improvements were found with students in the domains of problem solving, cognition, and positive attitudes when they were involved in PBL (Dischino et al., 2011; Tseng et al., 2013). These research studies are important to

consider when developing strategies and courses that could be explored when designing a PBL model. For example, aligning authentic problems and projects with cross-curricular connections, developing lesson plans that specify learning objectives, creating the scope and sequence of the projects, and developing assessment tools to measure student progress on the learning objective and skill outcomes are ambitious curriculum goals. These research studies also support a curriculum focused on STEM course outcomes using the PBL model. This focus could extend the number of students, including women and minorities, who pursue college and careers in STEM fields. Students who participate in PBL yet do not choose a STEM focused college or career, might be able to increase their STEM literacy to their advantage when pursuing other fields they choose.

Curriculum assessments should be developed that allow teachers to look at the progress students are making academically and socially in a formative format. In so doing, they can facilitate growth for their students and suggest improvements for PBL curriculum, professional development, and instructional strategies.

Recommendations for future research. The limited prior research on the effects of PBL on high school students, and the lack of the same for the study of PBL in alternative school settings, is a concern that can be addressed through additional research. Although this study attempted to fill this perceived gap in the literature, there are three recommendations for further research to expand the results of the research questions from this study: school connectedness, problem solving, and college and career readiness. Both qualitative and quantitative studies could be designed to explore further into each of the research questions.

School connectedness. The results that lead to adopting the alternative hypothesis for research question 1: There is a significant difference in high school students' school connectedness between those who participate in project-based learning and those who do not participate in project-based learning, can be expanded. One possibility would be to study the correlation between the perception of school connectedness and each of the activities and elements that are explored with the NTN Student Climate Survey questions to find the most effective activities that lead to school connectedness. A study of this kind could assist educators in choosing the activities that are most effective. These studies might include student perceptions of connectedness in peer-to-peer interactions, student-to-teacher interactions, and how students respond to questions on their sense of community.

***Problem solving*.** This study resulted in adopting the alternative hypothesis for research question 2: There is a significant difference in high school students' ability to work with others to solve problems between those who participate in project-based learning and those who do not participate in project-based learning. Further research might inquire deeper into each of the problem-solving elements described in the NTN Student Climate Survey in order to carefully understand each of the specific problem-solving skills. Another possibility would be to design a study that measures student growth in problem-solving skills, and perhaps how those problem-solving skills translate to students' activities outside of the classroom.

A third possibility for future research would be to study the leadership role of female students involved in a PBL school specifically in STEM curriculum areas. Some reviewed research studies from Chapter 2 have shown that PBL can lead to improved

learning experiences and academic attitudes in STEM courses. Engaging young female students in the process of PBL may increase the likelihood that they will excel in STEM courses and discover leadership capacities in those areas.

College and career readiness. Although previously reviewed research showed some support for research question 3 for college and career readiness, this study did not find empirical evidence to adopt an alternative hypothesis for research question 3. Therefore, the null hypothesis was retained. There was no significant difference in high school students' college and career readiness between those who participated in project-based learning and those who do not participate in project-based learning.

First, a continuation of this research question might be to inquire into some of the possible explanations for the current null hypothesis in the domain of college readiness or career readiness. Research might be designed specifically around the PBL model and its effect on college readiness for alternative high school students. A study of the specific behaviors of staff members and their targeted conversations with students about how the skills they are learning from their PBL projects might increase the students' perception of a connection between their PBL experience and college readiness would be encouraged.

The same ideas might be used with research on career readiness. The types of conversations between students, parents, teachers and counselors focused around career opportunities may produce positive results when considering the effect of the PBL model experiences.

The results of the reviewed literature from Chapter 2 showed that students tend to retain knowledge over time. Another recommendation for exploring further study on research question 3 might be to complete a similar study to this research study, but to

separate the responses by grade level. This consideration of what students report over time may explain the lack of statistical significance for research question 3 of this study. There is a possibility that students in Grades 9 and 10 are not yet experienced enough to connect their current learning with future college and career options. A qualitative study might be designed to study students who have graduated from an alternative high school with PBL as an instruction model, to discover if they can attribute their PBL learning experience from an alternative high school setting to their perceived successes in college and career.

Conclusion

The presentation of the problem statement, theoretical rationale, significance, and purpose of this study in Chapter 1 established that it is imperative for educators to explore alternative approaches to conventional instruction that addresses the needs of the over 1.2 million students who drop out of school (U.S. Census Bureau, 2013), and in turn, have those students experience success in order to stay in school. The reform effort of the No Child Left Behind Act has not served to improve educational standards, as there has been little change in existing models and methods for instruction. As Williams (2014) emphasized, instructors and instructional methods need to adapt to the needs of students. Indicated by Davidson et al. (2012), a PBL model is a framework to be considered when addressing the needs of 21st century education.

A review of previous research in Chapter 2 produced support that project-based learning has the potential to positively impact students' learning, efficacy, motivation, and college and career readiness. There is some indication that schools need different approaches to transfer knowledge (Egenrieder, 2010; Williams, 2004). In addition, the

PBL literature reviewed indicated support for positive effects on the academic impact of students, including knowledge transfer (Eskrootchi & Oskrochi, 2000) and knowledge construction within a social activity (Tamim & Grant, 2013). In an early study, Makinster et al. (2001) found that the experience of collaboratively working with other students toward a shared goal had a much larger influence than the individual experience. Considering the limited research on high school education (Eubanks & Eubanks, Savoie et al., 2004), and even fewer studies on the impact of alternative school education (Lange & Sletten, 2002; Tissington, 2006), this study specifically fills a gap in the literature that connects the effects of PBL with students' perception of school connectedness and learning experiences in alternative high school students, and by definition, those students who have not been able to succeed in traditional high school settings.

There is some suggestion that adoption of the voluntary standards of the Council of Chief State School Officers could positively affect school policies on PBL. The goal of making education equitable for all students to be successful might be achieved when considering PBL as an instructional model, because the standards do not detail exactly how the students can meet the goals. Teachers using the CCSSO standards have more flexibility to design and apply new understandings of teaching and learning. This can be a considerable advantage when designing and implementing a PBL model and supporting the use of public funds toward professional development and collaborative planning for teachers.

As described and explored in Chapter 3, a quantitative, quasi-experimental design was determined useful in developing the answers to the research questions. The main instrument for the study was the NTN Student Climate Survey of responses from students

in two Central New York alternative schools. A MANOVA was used to evaluate the three research questions, which were:

1. In comparison to students who do not participate in project-based learning, to what extent do high school students who participate in project-based learning report a greater connection to their school?
2. In comparison to students who do not participate in project-based learning, to what extent do high school students who participate in project-based learning report working better with others to solve problems in comparison to students who do not participate in project-based learning?
3. In comparison to students who do not participate in project-based learning, to what extent do high school students who participate in project-based learning report that they are better prepared for college and career in comparison to students who do not participate in project-based learning?

The study results in Chapter 4 indicate statistically significant support to adopt the alternative hypothesis for research questions 1 and 2. With no empirical support, the null hypothesis for research question 3 was retained.

In this final chapter, the discussion of this study investigates the results, frames the implications of the findings, examines some possible limitations of the study, and proposes some specific recommendations for leaders and teachers to engage in designing and implementing a PBL model for their students.

Alternative high schools present an opportunity for educational leaders to encourage an alternative to traditional teaching methods. For students who have attended alternative schools and have not achieved academic success in their previous school

placements, the alternative instructional model of project-based learning has a promising future. As a result of this study, researchers have some new ideas for continued studies in support of this model. In addition, educators in alternative high schools can use the recommendations to design and implement PBL in their schools. Should they do so, the potential to have a positive influence on students connecting to their schools and working better with others to solve problems can be an enticing result.

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Appendix A

2015-16 FALL Student Culture Survey

Q1 Welcome to the New Tech Network Student Culture Survey for (Name of School) Your feedback is extremely valuable to us and we are excited to have you participate! With this survey, we would like to gather information from you for two purposes:
1. To provide feedback to your school administrators and teachers about your perceptions of the culture at your school.
2. To allow New Tech Network to understand how school culture is related to better outcomes for you and your peers.
The answers you provide are anonymous. We will provide your school with a summary of answers from all of the students in your school that participate in the survey. However, we will also provide schools with written responses to open-ended questions. To ensure your anonymity, please do not disclose information in your written responses that may allow for your identification. Please complete the 15-minute survey as directed by your administrator and teachers. While taking the survey, be sure to read the directions at the top of each page. If you have any questions, please contact your school administrator!

Q2 On this page, we want to learn more about who you are. In order to provide useful feedback to the staff at your school, you MUST answer the question about how long you have attended (Name of School). The other questions are optional, but will help us understand differences in students' experiences in NTN schools.

Q4 Counting this school year as 1, how many years have you attended this school?
- ❍ 1 (1)
- ❍ 2 (2)
- ❍ 3 (3)
- ❍ 4 (4)
- ❍ 5 (5)
- ❍ 6 (6)
- ❍ 7 (7)
- ❍ 8 (8)

Q5 What grade are you in?

- ❍ 6th grade (1)
- ❍ 7th grade (2)
- ❍ 8th grade (3)
- ❍ 9th grade (4)
- ❍ 10th grade (5)
- ❍ 11th grade (6)
- ❍ 12th grade (7)
- ❍ My school does not use grade levels (8)

Q6 What is your gender?

- ❍ Male (1)
- ❍ Female (2)

Q7 What is your race? Select the one with which you most closely identify.

- ❍ American Indian (1)
- ❍ African American (2)
- ❍ Asian (3)
- ❍ Hispanic (4)
- ❍ Pacific Islander (5)
- ❍ White (Non-Hispanic) (6)
- ❍ Multi-racial (7)
- ❍ Other (8) _____

Q8 What is the highest level of education completed by your parent(s) or guardian(s)?

- ❍ Did not graduate high school (1)
- ❍ High school graduate (2)
- ❍ Some College (attended, but did not graduate college) (3)
- ❍ Certificate Program (less than 2 year college program) (4)
- ❍ AA or Associates Program (2 year degree such as community or junior college or 2 year technical program) (5)
- ❍ BA or Bachelors Program (4-5 Year University Degree) (6)
- ❍ Graduate or Professional Degree (MA, PhD, JD, MD like a lawyer or doctor) (7)
- ❍ Do not know (8)

Q9 On this page, we want to know about how connected you feel to your school.

Q10 Which of the following statements best describe how proud you are of your school? Check only one.

- ❍ There is not much to be proud about. (1)
- ❍ I am somewhat proud of my school. (2)
- ❍ I am very proud of my school. (3)

Q11 What things make you proud of your school?

Q12 What things could be improved, so that you would be very proud of your school?

Q13 How much do you agree or disagree with the following statements?

	Strongly Disagree (1)	Disagree (2)	Agree (3)	Strongly Agree (4)
I contribute positively to my school. (1)	❍	❍	❍	❍
I have been recognized for something positive at my school. (3)	❍	❍	❍	❍
I take on leadership roles in my school. (2)	❍	❍	❍	❍
I receive a high quality education at this school. (6)	❍	❍	❍	❍
I am encouraged to be a strong learner at school. (5)	❍	❍	❍	❍

Q14 On this page, we want to know what you think about learning through projects.

Q15 How often do the projects in your classes provide you with the opportunity to?

	Never (1)	Occasionally (2)	Very Often (3)	Always (4)
Feel excited about the work. (1)	❍	❍	❍	❍
Help my community or others. (2)	❍	❍	❍	❍
Allow me to be creative and innovative. (3)	❍	❍	❍	❍
Present to an audience other than students and teachers. (4)	❍	❍	❍	❍
Talk with experts and community members about my ideas to solve problems. (5)	❍	❍	❍	❍
Learn the skills to successfully complete projects. (6)	❍	❍	❍	❍

Q16 How much do you agree or disagree with the following statements about working with other students?

	Strongly Disagree (1)	Disagree (2)	Agree (3)	Strongly Agree (4)
I usually work in groups in my classes. (1)	❍	❍	❍	❍
I have learned how to work well with other students. (2)	❍	❍	❍	❍
Students in groups share responsibility for the work. (3)	❍	❍	❍	❍
Students in groups communicate respectfully. (4)	❍	❍	❍	❍

Q17 On this page, we want to know what you think about the rules at your school.

Q18 How much do you agree or disagree with the following statements about rules at your school?

	Strongly disagree (1)	Disagree (2)	Agree (3)	Strongly Agree (4)
School staff and students make the rules together. (1)	❍	❍	❍	❍
The rules make sense. (2)	❍	❍	❍	❍
There is a process for students to change the rules. (3)	❍	❍	❍	❍
Rules are enforced fairly for all students. (4)	❍	❍	❍	❍

Q19 How much do you agree or disagree with the following statements about students following or breaking the school rules?

	Strongly Disagree (1)	Disagree (2)	Agree (3)	Strongly Agree (4)
Most students follow the rules. (1)	❍	❍	❍	❍
Consequences for breaking the rules apply equally to everyone. (2)	❍	❍	❍	❍
Students who break the rules talk with school staff to understand what they did wrong. (3)	❍	❍	❍	❍
Students who break the rules can earn back trust from teachers and peers. (4)	❍	❍	❍	❍

Q20 On this page, we want to know about your relationships with other students at school.

Q21 How much do you agree or disagree with the following statements about your experiences with other students at school?

	Strongly Disagree (1)	Disagree (2)	Agree (3)	Strongly Agree (4)
I feel physically safe on campus. (1)	❍	❍	❍	❍
My peers treat me with respect. (2)	❍	❍	❍	❍
I feel accepted for who I am at school. (3)	❍	❍	❍	❍

Q22 How much do you agree or disagree with the following statements about the social interactions of students at school?

	Strongly Disagree (1)	Disagree (2)	Agree (3)	Strongly Agree (4)
Students at my school feel physically safe. (1)	❍	❍	❍	❍
Students at my school respect each other. (2)	❍	❍	❍	❍
Most students at my school get along. (3)	❍	❍	❍	❍
Nearly everyone is accepted at my school. (4)	❍	❍	❍	❍

Q23 What suggestions do you have for improving peer relationships at your school?

Q24 On this page, we want to know about student relationships with adults at school.

Q25 How much do you agree or disagree with the following statements?

	Strongly Disagree (1)	Disagree (2)	Agree (3)	Strongly Agree (4)
Most teachers know me well. (1)	❍	❍	❍	❍
Most teachers care about my success. (2)	❍	❍	❍	❍
Most teachers treat me with respect. (3)	❍	❍	❍	❍
Most teachers recognize my effort. (4)	❍	❍	❍	❍
If I was in trouble, there is at least one school staff member I could go to for help. (5)	❍	❍	❍	❍

Q26 Which of the following statements best reflect how you might handle a situation where one of your friends was about to hurt someone else or hurt himself/herself? Check only one.

- ❍ I would never tell on my friends. (1)
- ❍ I might tell other students, but I would not tell school staff. (2)
- ❍ There are one or two school staff members that I could talk to. (3)
- ❍ I would tell any adult on campus who I thought could help. (4)

Q27 What suggestions do you have for improving interactions between students and staff at your school?

Answer If What grade are you in? 12th grade Is Selected Or What grade are you in? 11th grade Is Selected Or What grade are you in? 10th grade Is Selected Or What grade are you in? 9th grade Is Selected

Q28 On this page, we want to know how prepared you feel for life after high school.

Answer If What grade are you in? 12th grade Is Selected Or What grade are you in? 11th grade Is Selected Or What grade are you in? 10th grade Is Selected Or What grade are you in? 9th grade Is Selected

Q29 How ready do you feel for each of the following?

	Not at all ready (1)	I still have a lot to learn (2)	Somewhat ready, but nervous (3)	Ready to go! (4)
Getting a job (1)	❍	❍	❍	❍
Applying for college (2)	❍	❍	❍	❍
Obtaining financial aid for college (3)	❍	❍	❍	❍
Taking classes at a community college (4)	❍	❍	❍	❍
Enrolling in a 4-year college (6)	❍	❍	❍	❍
Success in college (5)	❍	❍	❍	❍

Answer If What grade are you in? 12th grade Is Selected Or What grade are you in? 11th grade Is Selected Or What grade are you in? 10th grade Is Selected Or What grade are you in? 9th grade Is Selected

Q30 How much do you agree or disagree with the following statements about how well your school prepares students for life after high school?

	Strongly Disagree (1)	Disagree (2)	Neither Agree nor Disagree (3)	Agree (4)	Strongly Agree (5)
School staff talk with students about options after high school. (1)	❍	❍	❍	❍	❍
School staff teach job hunting skills. (2)	❍	❍	❍	❍	❍
School staff help with college applications. (3)	❍	❍	❍	❍	❍
School staff provide information about what is required to be accepted at the college of my choice. (4)	❍	❍	❍	❍	❍

Answer If What grade are you in? 9th grade Is Selected Or What grade are you in? 10th grade Is Selected Or What grade are you in? 11th grade Is Selected Or What grade are you in? 12th grade Is Selected

Q31 My current plan for the year after I graduate high school is:

- ❍ I don't have a plan (1)
- ❍ Enter the workforce (2)
- ❍ Enlist in the military (3)
- ❍ Enroll in community college (4)
- ❍ Enroll in a technical or trade school (5)
- ❍ Enroll in a 4-year college (6)
- ❍ Other (7) _____

Q32 The next set of questions ask about your experience using Echo, New Tech's online learning platform. Please think about your experience this year with Echo as you answer the following questions.

Q33 Counting this school year as 1, how many years have you been using Echo?

- ❍ 1 (1)
- ❍ 2 (2)
- ❍ 3 (3)
- ❍ 4 (4)
- ❍ more than 4 years (5)
- ❍ I don't use Echo (6)

Answer If Counting this school year as 1, how many years have you been using Echo? 1 Is Selected

Q34 Please let us know about your comfort level in using Echo.

	Not At All Comfortable (1)	Somewhat Comfortable (2)	Comfortable (3)	Very Comfortable (4)
How comfortable were you with using Echo at the beginning of this school year? (1)	❍	❍	❍	❍
How comfortable are you using Echo today? (2)	❍	❍	❍	❍

Q35 Please rate the following areas in Echo in terms of needing improvement.By dragging and dropping the number boxes, please rank in order of preference.(1 is "needs the most improvement" and 9 is "needs the least improvement")

_____ Homepage (1)

_____ Events (2)

_____ Course (3)

_____ Course Gradebook (4)

_____ Grades (5)

_____ Groups (6)

_____ People (7)

_____ Library (8)

_____ Tools (9)

_____ Other, please specify: (10)

Q36 Is there anything else you would like us to know about your experience with Echo? Please give details below.

Q37 Thank you for participating in the New Tech Network Student Culture Survey! Your responses will be combined with other student responses from your school to create a report for your school administrator. Please contact your school administrator if you have any questions about the survey.

Q38 I would rate my experience at ${e://Field/Organization%20Name} as positive

- ❍ Strongly Disagree (1)
- ❍ Disagree (2)
- ❍ Neither Agree nor Disagree (3)
- ❍ Agree (4)
- ❍ Strongly Agree (5)

Appendix B

New Tech Network

T: 707.253.6951 F:
800.856.7038
www.newtechnetwork org

To Whom It May Concern:

This letter formally grants permission for Jody Manning to use the New Tech Network Student Climate Survey as a tool for gathering data for his dissertation.

The New Tech Network Student Climate Survey is a proprietary, copyrighted survey instrument administered primarily in schools that are members of, and pay fees to, the New Tech Network. We understand that Jody Manning intends to administer the instrument in schools both within and outside the New Tech Network, at his sole discretion.

New Tech Network will not provide any student-level data for Mr. Manning's use. However, New Tech Network has provided data on the statistical reliability and validity of the instrument. Any student-level data Mr. Manning collects using the New Tech Network Student Climate Survey is subject to the Internal Review Board of the institution overseeing Mr. Manning's dissertation work.

Mr. Manning agrees to cite New Tech Network as the author of the survey instrument in any written material, which references the instrument.

Sincerely,

Sherrie Reed Director of Research

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Appendix C

OCMBOCES

Committed to Your Success

V. Ann Wright President

OCM BOCES Board of Education (315) 433-2602 awright@ocmboces.org

Permission

I, as President of the Onondaga Cortland Madison BOCES Board of Cooperative Education Services (OCM BOCES) grant doctoral candidate Jody F. Manning permission to use the 2015-2016 New Tech Climate survey data results for the purpose of conducting research for the Ed.D. Program in Executive Leadership at St. John Fisher College. The candidate has permission to use the engagement data for the purpose of the study from January 2016 - December 31, 2016.

V. Ann Wright

V. Ann Wright, President

OCM BOCES Board of Education