THE TEACHING OF 21ST CENTURY SKILLS THROUGH PROJECT-BASED LEARNING AND PROFESSIONAL DEVELOPMENT FOR CAREER AND TECHNICAL EDUCATION

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Dissertation Prepared for the Degree of

DOCTOR OF PHILOSOPHY

UNIVERSITY OF NORTH TEXAS

December 2019

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Petrunin, Kristin Firmery. *The Teaching of 21st Century Skills through Project-Based Learning and Professional Development for Career and Technical Education*. Doctor of Philosophy (Applied Technology and Performance Improvement), December 2019, 61 pp., 12 tables, 17 figures, 2 appendices, references, 65 titles.

The purpose of this non-experimental, quantitative study is to investigate the relationship between the use of project-based learning (PBL) by secondary business teachers and time spent in professional development of secondary business teachers for the teaching of 21st century skills. The four identified 21st century skills that will be researched include: (1) critical thinking, (2) collaboration, (3) communication, (4) creativity and innovation. A sample of 316 secondary business teachers were surveyed about their classroom practice and reflection of teaching 21st century skills. This study used a modified version of the 21st Century Teaching and Learning Survey. Survey results were analyzed for relationships using correlational and regression analysis. Business teachers reported a statistically strong relationship between the use of PBL and the teaching of 21st century skills. A statistically significant relationship between time spent in professional development and the teaching of 21st century skills was not found. Regression results indicated that the use of PBL had an impact on the teaching of 21st century skills. This research guides teachers, school administrators, and CTE directors at the state and district level towards the creation of professional development and implementation strategies when applying PBL methods in career and technical education settings.

ACKNOWLEDGEMENTS

Throughout the writing of this dissertation I was lucky to have Dr. Jeff Allen as my constant support. For the past seven years, he has guided me through this process with grace and understanding. His compassion for doctoral students is without comparison. Thank you for helping me to land all my planes!

This dissertation would not have been possible without the work of my amazing committee. Dr. Karen Johnson was a supportive voice, always adding important ideas to the formation of the study. Dr. Mariya Gavrilova Aguilar's expertise in research methods was invaluable in the formulation of the study as a whole. In addition to my committee, I would like to thank Dr. Elizabeth Bailey for hours of editing support.

I would like to thank my colleagues, students, and administrators at New Tech High @ Coppell for giving me grace through this demanding research process. They are a constant inspiration of what secondary education should look like. Thank you for encouraging me to pursue my passion! I would also like to thank my colleagues at Texas DECA and Coppell ISD for empowering and helping me to gather data for this study.

In addition, I would like to thank my parents, grandparents, and in-laws for their constant encouragement. The "Are you finished?" phone calls helped me in the final push. I would like to thank my children, Alex and Amelia. I promise the time to make up for all the time that I missed with you. Finally, I would like to dedicate this dissertation to my husband, Paul Petrunin, who has been my cheerleader, advisor, shoulder to cry on, and best friend throughout my journey. I love you more than words can express!

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CHAPTER 1

INTRODUCTION

Employers from across the globe are reporting concerns about the skill level of high school graduates (Mukherjee, 2018; Stair, Hock, Warner, Levy, & Conrad, 2017). The U.S. Bureau of Labor Statistics projects that by 2024 over 81 percent of jobs will be in the service-providing sector, while manufacturing jobs will see declines (Henderson, 2015). This indicates the importance in a shift of mindset for employment in the 21st century. Career and technical education (CTE) programs that taught hands-on technical skills will need to incorporate 21st century skills (Gordon, 2014). The current workforce demand is focused on hiring employees with abilities to attain knowledge on their own and problem solve (Henry-Nickie, 2018). Employees at the start of their career journey often look for companies that provide professional development opportunities to maintain and enhance previously acquired skills (Kosur, 2015). Training for entry-level employees is expensive and the return on investment for companies can be unclear (Smith, 2014). Ideally, new employees should come into the workforce with foundational knowledge and 21st century skills that can be applied to many industries. The national lack of 21st century skills is a problem seen at the local level as regions realize an increasing gap of finding qualified retail employees (Hethcock, 2018). To provide the workforce with qualified candidates, career and technical education teachers look for ways to teach content and build student skills.

On July 31st, 2018, President Donald Trump signed the *Strengthening Career and Technical Education for the 21st Century Act (Perkins V)* reauthorizing the *Carl D. Perkins Career and Technical Education Act of 2006 (Perkins IV)* (Loudenback, 2018). According to the *Perkins*

V (United States, 1998), career and technical education (CTE) is defined as organized educational activities that support the development of academic knowledge, higher-order reasoning and problem-solving skills, work attitudes, employability skills, technical skills, and occupation-specific skills. This definition differs from Perkins IV by replacing "academic skills" with "employability skills," emphasizing the demand for 21st century skill integration into CTE courses (Advanced CTE, 2018). This slight change of terminology in federal policy highlights the need for teachers to focus on connecting employability skills to student work. These policy changes reflect the evolving demands of the workplace requiring teachers to incorporate new content and 21st century skills into CTE classrooms.

State governments have the ultimate power over the CTE policies and programs, as the U. S. does not currently have a federal system for joining educational standards and global workforce needs (Stone, 2017). In response to a demand from the federal government for common state educational standards for core academic courses, the National Governors' Association and the Council of Chief State School Officers took part in the development of Common Core State Standards (CCSS) across 48 states (Rothman, 2012). States banded together to share the work of creating standards that could be implemented throughout all of the states. CCSS were completed in 2010 with input from all participating 48 states, yet the adoption of the final product was still the decision of each individual state (Rothman, 2012). Similar to the creation of CCSS, the National Association of Sate Directors of Career and Technical Education Consortium (NASDCTEc) proposed the creation of the Common Career Technical Core (CCTC) standards for use in the CTE classroom in 2012 (Yankoski, 2012). NASDCTEc brought together subject matter experts and state CTE directors to develop the

standards in 2012. Forty-two states currently use the Common Career Technical Core (CCTC) to guide the learning for their CTE departments (National Association of State Directors of Career Technical Education Consortium, 2013). The CCTC standards include all 16 career pathways. These standards guide the instruction of the course, but do not account for the hands-on activities needed for integration during the course. The guide outlines 33 standards for business education courses (National Association of State Directors of Career Technical Education Consortium, 2013). The standards include problem-solving and critical thinking but miss the mark on collaboration and communication. These are two of the most important skills that project-based learning (PBL) environments can teach.

The definition of a 21st century skill set is broad (Van Laar, Van Deursen, Van Dijk, & De Haan, 2017). Van Laar et al.'s (2017) review of literature over the past sixteen years included the most frequently reported skills included: information management, critical thinking, creativity, problem solving, and communication. Their study identified that 21st century skills are broader in scope than digital skills. The number of skills required in entry-level positions increased from 2010 to 2016 (D'Innocenzio, 2018; George-Parkin, 2018). The need for more individual job skills is in large part due to evolving technologies. For example, in addition to traditional customer service requirements, companies are looking for experience in electronic inventory systems (D'Innocenzio, 2018). In 2011, Hixson et al. created a list of 21st century skills based on the International Innovative Teaching and Learning study (Shear, Novais, Means, Gallagher, & Langworthy, 2010), the William and Flora Hewlett Foundation's (2010) framework for deeper learning, and the Partnership for 21st Century Skills (2016). The list of 21st century

skills (listed in Table 1) was used to identify the relationship between PBL and 21st century skills defined in the West Virginia 21st Century Teaching and Learning Survey.

Table 1

Definitions of 21st Century Skills

21st Century Skills	Definition
Critical Thinking Skills	Critical Thinking Skills refer to students being able to analyze complex problems; investigate questions for which there are no clear-cut answers, evaluate different points of view or sources of information, and draw appropriate conclusions based on evidence and reasoning.
Collaboration Skills	Collaboration Skills refer to students being able to work together to solve problems or answer questions, to work effectively and respectfully in teams to accomplish a common goal, and to assume shared responsibility for completing a task.
Communication Skills	Communication Skills refer to students being able to organize their thoughts, data and findings and share these effectively through a variety of media, as well as orally and in writing.
Creativity and Innovation Skills	Creativity and Innovation Skills refer to students being able to generate and refine solutions to complex problems or tasks based on synthesis, analysis and then combining or presenting what they have learned in new and original ways.
Self-Direction Skills	Self-direction Skills refer to students being able to take responsibility for their learning by identifying topics to pursue and processes for their own learning, and being able to review their own work and respond to feedback.
Global Connections	Global Connections refer to students being able to understand global, geo-political issues including awareness of geography, culture, language, history, and literature from other countries.
Local Connections	Local Connections refer to students being able to apply what they have learned to local contexts and community issues.
Using Technology as a Tool for Learning	Using Technology as a Tool for Learning refers to students being able to manage their learning and produce products using appropriate information and communication technologies.

Source: Hixson, Ravitz, and Whisman, 2012.

The concept of teaching 21st century skills is not completely new to education; however, how the skills are taught has evolved (Silva, 2009; Urbani, Roshandel, Michaels, & Truesdell,

2017). Past educational teaching methodologies focused on drill and memorization of knowledge instead of building on what the student can do with knowledge (Silva, 2009). Some teachers and schools implement the teaching and assessment of 21st century skills, but this approach is not consistently seen in US classrooms (Rotherham & Willingham, 2010). Rotherham and Willingham (2010) argue that without robust professional development in evidence-based teaching methods, teachers do not have the proper support to implement the teaching of 21st century skills.

One of the most promising teaching methods for teaching 21st century skills is project-based learning (PBL). Many research studies have identified changing definitions to PBL (Du & Han, 2016). Theories and applications of many PBL models are attributed to the various definitions depending on the environment of application for the teaching method (Ravitz, 2009). The Buck Institute for Education (2016) provides a definition of "a systematic teaching method that engages students in learning knowledge and skills through an extended inquiry process structured around complex, authentic (real-life) questions and carefully designed products and tasks" (p. 4). Mergendoller, Markham, Ravitz, and Larmer (2006) expand on The Buck Institute for Education's definition by stating that PBL is "a systemic teaching method that engages students in learning essential knowledge and life-enhancing skills through an extended, student-influenced inquiry process that is structured around complex, authentic questions and carefully designed products and tasks" (p. 587). This definition emphasizes the importance of life-enhancing skills being taught to the student through PBL.

PBL has been shown to increase the teaching of 21st century skills in core academic subjects (Hixson, Ravitz, & Whisman, 2012). To facilitate the use of PBL in the classroom,

teachers should participate in directed professional development to ensure the connection of the teaching methodology to the desired student outcomes (Allen, Bracey, & Gavrilova, 2010; English, 2013). Effective professional development can be costly and ineffective if the support does not directly relate to the needs of the teacher (Mader, 2015). The cost of professional development is left to be covered by school districts (Layton, 2015), but new changes from the federal government could offer additional funding for the professional development of CTE teachers.

Additional change to the original Carl D. Perkins Career and Technical Education Act of 2006 includes an emphasis on providing funding for professional development and "supporting the development and enhancement of innovative delivery models for career and technical education related work-based learning, including project-based learning" (CTE) teachers (United States, 1998). The new emphasis on professional development gives federal funding to districts to meet the individual needs of the CTE community (Schaffhauser, 2018). Enacting Perkins' funding into law is in response to a demand for an increased professional development; but the law is written to allow for the states to determine their own course of action for professional development. Therefore, an argument must be made to support the use of professional development for teachers to adequately prepare their students for a changing workforce.

Large companies such as Disney and Nordstrom pride themselves on hiring employees that use communication skills to deliver exceptional and customer service approaches (Moore, 2017). Students must be able to apply academic knowledge and skills to a variety of real-world situations. Professional skills consist of collaboration, communication, problem solving and

critical thinking beyond the scope of core academic teaching. Many companies make hiring decisions based on the applicant's level of professional skills. Communication and constant technological advances indicate that employees must use problem-solving skills to adapt to changing work environments and new tools for entry-level positions within Prezi and Adobe (Beaton, 2017).

One of the biggest competitive advantages for brick and mortar stores over online shopping is the ability to have inventory on hand. To meet the demand of the just-in-time shopper, stores require employees to have a knowledge of inventory systems as well as communication skills to help find items across multiple store locations.

The changing dynamic of skills necessary for students to obtain employment requires new strategies to reach students (Cheung, 2016). Research into PBL practices within core academic content (math, English, social studies, and science) suggests that teachers trained in PBL teach 21st century skills more than non-PBL trained teachers (Hixson et al., 2012). Currently, there is little research into the secondary business classroom's use of PBL as an innovative teaching strategy (Tanner, 2012). Additional research could enhance the development of teacher's professional development for the use of PBL to teach 21st century skills.

Significance of Study

An analysis of current global workforce demands (Henderson, 2015; Mukherjee, 2018; Stair et al., 2017) revealed that graduates do not have the 21st century skills needed to gain employment. Additional research (Ravitz, Hixson, English, & Mergendoller, 2012) suggests that

the use of PBL as a teaching methodology increases the teaching of 21st century skills in non-CTE classes.

This study investigates the use of PBL as a predictor for the teaching of 21st century skills in secondary business education. While PBL research is plentiful, little research has been conducted on the use of PBL in the CTE classroom (Tanner, 2012). The linkage of 21st century skill teaching and assessment to PBL professional development has been identified within core academic subject areas (Ravitz et al., 2012). This study attempts to determine if similar linkages could occur within the context of CTE teachers.

Theoretical Framework

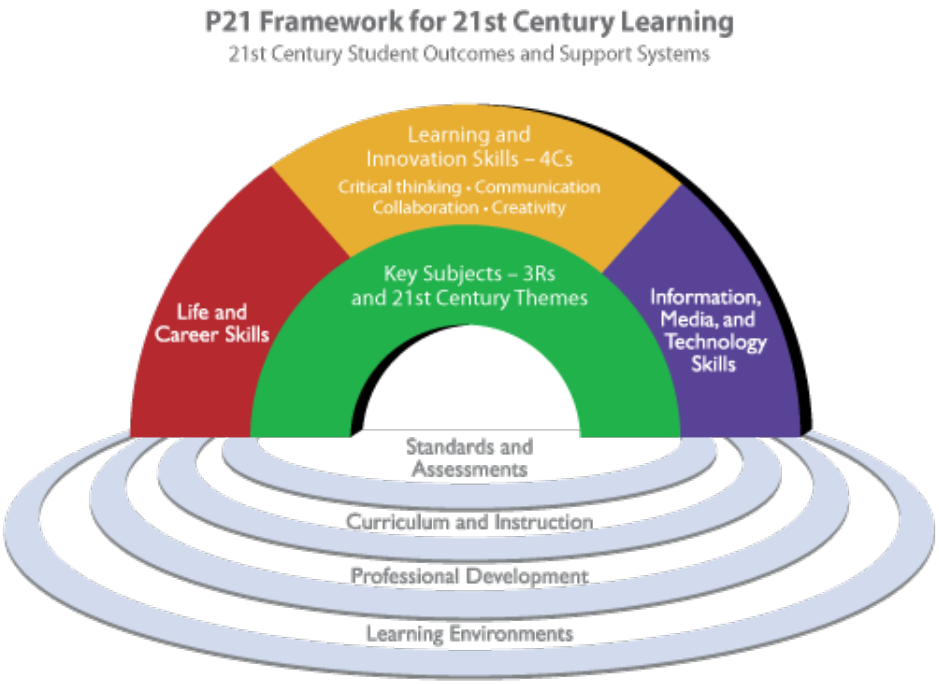

Figure 1. Framework for 21st century learning (Partnership for 21st Century Learning, 2016).

In 2002, the Partnership for 21st Century Learning (P21) was founded to ensure students in US K-12 education were ready for the challenges of the 21st century (Partnership for 21st Century Learning, 2016). The P21 framework was designed by teachers, business leaders, and

educational experts to illustrate the skills and knowledge students need to be successful in work, life and citizenship. The arches of the rainbow represent student outcomes, while the pools at the bottom represent support systems (Partnership for 21st Century Learning, 2016). This framework sets the stage for the professional development that is required to teach the 21st century skills through instructional practices.

Purpose of the Study

The purpose of this non-experimental, quantitative study is to investigate the relationship between the use of PBL by secondary business teachers and time spent in professional development of secondary business teachers for the teaching of 21st century skills. Specifically, this study examines the secondary business teacher's PBL professional development levels and perceptions of four previously identified 21st century skills. The four identified 21st century skills that will be researched include: (1) critical thinking, (2) collaboration, (3) communication, (4) creativity and innovation. This research guides teachers, school administrators, and CTE directors at the state and district level towards the creation of professional development and implementation strategies when applying PBL methods in career and technical education settings.

Research Questions and Hypothesis

Quantitative hypotheses are based on predictions the researcher makes towards the expected relationships between variables (Creswell, 2009). The following null hypothesis guides the research:

> *H_o1: There is no statistically significant relationship between using PBL and teaching 21st century skills in secondary business education.*

H_o2: There is no statistically significant difference between time spent in professional development and teaching 21st century skills in secondary business education.

H_o3: There is no statistically significant interaction between using PBL and time spent in professional development on teaching 21st century skills in the secondary business education classroom.

Independent Variables

1. PBL-The secondary business teacher's usage of PBL in the classroom.
2. Professional development-The secondary business teacher's time spent in professional development.

Dependent Variable

Classroom practice and teachers' reflection of teaching 21st century skills in secondary business education.

Limitations

This study is limited to a one-time survey data. Participation in the study was voluntary and teachers had a self-selection bias (Hixson et al., 2012). Survey participants might not be honest in their responses due to the nature of self-assessment. The study uses close-ended, Likert scale survey items, rather than open-ended responses which could hinder participation in the survey. The survey was distributed via online software that limits the respondents to those having access to technology and internet access.

Summary

PBL has the potential to transform CTE classrooms by adding a focus on teaching 21st century skills. Current research is lacking in the connection of PBL to CTE (Tanner, 2012). Little research has been done that directly links PBL and secondary business classrooms. The current

demands of the workforce for an increase in 21st century skills indicate that there is a growing need to understand the teaching strategies used to reach CTE students (Rotherham & Willingham, 2010). This quantitative study aims to identify teacher perceptions of 21st century skill teaching through PBL to increase successful use of the teaching strategy in the secondary business classroom.

CHAPTER 2

LITERATURE REVIEW

This literature review summarizes previous research on project-based learning (PBL) as a teaching strategy for career and technical education (CTE) business classes. Due to limited research in the area of PBL in a CTE business classroom setting, this review expanded the scope of research to include PBL implementation in various settings (e.g., rural schools or non-secondary schools). In addition, relevant studies investigating 21st century skills were included to examine the possible obstacles specific to a subject area.

Career and Technical Education (CTE)

A preliminary case study found that CTE students develop 21st century skills through PBL, making them more employable in the global workforce (Tanner, 2012). Students can learn 21st century skills throughout the process of PBL, although 21st century skills can be hard to quantify through standardized testing. Classrooms that choose to implement PBL produce students that can enter a workforce based on performance in collaboration, planning, organization, and negotiation instead of standardized test scores (Tanner, 2012). To support the use of PBL in CTE classrooms, state governments must enact policies to promote professional development in PBL for CTE teachers.

Secondary Business Education

It is believed that early business education came from apprenticeships looking to advance their knowledge of the company by learning the books (Gordon, 2014). The first course offered for teachers in business education was taught in 1898 (Walker, Huffman, &

Beaumont, 1956). From the start of business education in the U. S., curriculum and instructional practices demanded continuous development to keep up with the dynamics of the national workforce. Business principles were first organized around secretarial skills, but shifted to managerial systems and entrepreneurship (Gordon, 2014). Business education continuously responds to emerging workforce development needs (Polkinghorne, 2015).

21st Century Skills

A survey of 42 secondary teachers was conducted to determine the effect of PBL implementation on the teaching of 21st century skills (Hixson et al., 2012). The respondents were divided into two equal groups of 24 for comparison and validated scores based on their self-selected level of PBL training and PBL usage. Researchers divided respondents into groups due to substantial statistically significant effect sizes between each group.

> The evaluation used survey responses from a selected sample of 24 teachers and found significant effect size differences between teachers who used PBL with extended professional development and other teachers. The overall measure of 21st century skills teaching was positively correlated with time spent in professional development ($r = .34$, $p < .01$), the number of extended assignments ($r = .47$, $p < .001$), weeks conducting extended projects ($r = .29$, $p < .05$) , and overall class time devoted to extended projects ($r = .35$, $p < .01$). (Hixson et al., 2012, p. 10-11)

In 2018, a quantitative non-experimental dissertation study examined the relationship between teacher self-efficacy and instruction of 21st century skills based on teachers' perceptions (Davis, 2018). A convenience sample of schools in Southeastern Pennsylvania was selected by the researcher and 145 completed surveys revealed that there is a significant relationship between teacher self-efficacy scores and instruction of critical thinking skills scores, collaboration skills scores, creativity and innovation skills scores, local connection skills scores and self-direction skills scores in classroom practice.

CTE Teachers

CTE teachers have unique characteristics that set them apart from other (e.g. math, social studies, foreign language, etc.) secondary teachers (Foster, Foster, Hornberger, & McNally, 2015). Characteristics of typical CTE teachers are indicated in Table 2

Table 2

Characteristics of CTE Teachers

Characteristic	Explanation
Older	A CTE teacher often starts his or her teaching career at an older age than most teachers of regular education.
Experience	A CTE teacher typically has many years of content experience before entering the classroom.
Career Change	A CTE teacher makes a substantial career change to enter the classroom. Often, he or she is at the top of his or her particular field, and will transition into a career the individual knows little about, starting over at the bottom ring.
Commitment to Education	CTE teachers make a commitment to a lifetime of education. Not only do they have to maintain currency in the technical field that they left, but also play "catch up" in their new field. In many states, "alternatively credentialed" CTE teachers have to acquire a substantial number of college credits in teaching pedagogy while simultaneously working in a new field.

Note: Adapted from Cole, Foster, Foster, and McNally (2014).

A majority of CTE teachers do not come into the profession with a traditional college degree in education; instead, CTE teachers tend to have degrees related directly to their field of study (Cole, Foster, Foster, & McNally, 2014). A lack of formal educational degree has a large impact on the type of teaching methodology that is used in the classroom. Secondary business teachers have many choices in instructional strategies to use in their classrooms. Some districts and schools mandate the use of some strategies; but ultimately it is up to the teacher to implement. Teachers are on the front line of the learning in the classroom. They can see what

may really work for their educational environment. While administrators may have beliefs about what could work in the classroom, the responsibility falls on the shoulders of the teachers to carry out the work.

Teachers that are new to the profession face an even larger hurdle when it comes to implementing new teaching strategies. In addition to learning about new processes in technology, getting to know students and colleagues, and planning the delivery of advanced educational content, new CTE teachers are tasked with entering into a new field of work.

Role of Professional Development

Professional development in coordination with PBL usage has been shown to impact 21st century teaching and assessment (Ravitz et al., 2012). The Ravitz 2012 study found that teachers that received professional development in PBL consistently taught critical thinking, collaboration, communication, creativity, self-direction, local connections, and use of technology.

A content analysis study of the preparation of business teachers revealed that instructional strategies are critical in enabling students to acquire knowledge (Polkinghorne, 2015). The skills needed to implement these strategies are acquired through professional development of in-service teachers (Polkinghorne, 2015). For current business educators to meet the demands of the current workforce, professional development must be strategically aligned with the demands of the workforce.

PBL Process

A review of literature on the definition and process of PBL revealed another definition to

be “a student-centered model that organizes learning and studying around projects” (Du & Han, 2016). PBL enforces collaboration through the use of project organization and group work. Students are placed in workgroups to tackle the content and present their findings together. This is made possible by students creating workable project timelines, ensuring civility by using group social contracts, and encouraging open communication through constant group feedback sessions.

Planning projects is more than setting up benchmarks, rubrics, and resources (Prince & Felder, 2007). Teachers build projects around essential driving questions. PBL starts with a driving question and entry event or document. These items drive student engagement in the project.

The PBL process has evolved over the years from its infancy in medical school teaching (Maxwell, Bellisimo, & Mergendoller, 2001). The PBL process has been expanded to include the roles of students and teachers. Stix and Hrbek (2007) created the following steps for PBL:

1. The teacher-coach sets the stage for students with real-life samples of the projects they will be doing.
2. Students take on the role of project designers, possibly establishing a forum for display or competition.
3. Students discuss and accumulate the background information needed for their designs.
4. The teacher-coach and students negotiate the criteria for evaluating the projects.
5. Students accumulate the materials necessary for the project.
6. Students create their projects.
7. Students prepare to present their projects.
8. Students present their projects.

9. Students reflect on the process and evaluate the projects based on the criteria established in Step 4.

Research studies continue to show PBL connects students to real-world issues (Bell, 2010). Students reach further when learning is through inquiry self-directed learning principles. Motivation is sustained when students are engaged in real-world tasks. Each task can require students to gain multiple skills to complete the final product (Bell, 2010).

PBL also has been defined as "a model that organizes learning around projects" (Thomas, 2000). Thomas's (2000) study suggested that PBL has five criteria: project centrality, driving questions, constructive investigation, student-driven, and authenticity. Projects are refined multiple times to include the entire group's perspective. Collaboration becomes more than students individually writing down their ideas: rather, it becomes students sharing the beliefs with one another to find commonality. Siloed information from one student becomes a shared part of the group that they can display to others.

CHAPTER 3

METHODOLOGY

The purpose of the research is to understand the effect of project-based learning (PBL) usage and professional development on the teaching of 21st century skills for secondary business teachers across the United States. This chapter includes a description of the research design, population and sample, instrumentation, data collection, data analysis, and summary. The following null hypothesis is studied:

> *H_o1: There is no statistically significant relationship between using PBL and teaching 21st century skills in secondary business education.*
>
> *H_o2: There is no statistically significant difference between time spent in professional development and teaching 21st century skills in secondary business education.*
>
> *H_o3: There is no statistically significant interaction between using PBL and time spent in professional development on teaching 21st century skills in the secondary business education classroom.*

Research Design

This non-experimental study uses quantitative data gathered from a survey of secondary business teachers to measure their use of projects in the classroom, levels of professional development and teaching of 21st century skills. Based on the participant's self-selected level of project usage of PBL and professional development, survey information was validated and divided into equally proportioned groups.

Population

This study focused on secondary business teachers in the U.S. A report from the U.S. Department of Labor (2017) estimates that approximately 78,840 career and technical education (CTE) teachers are currently employed in the U.S. according to the National Center

for Educational Statistics School Staffing Survey. The report from 2017 did not include a breakdown of CTE teachers by subject area. According to an extensive U. S. Department of Education study in 2008, the U.S. was home to 81,582 CTE teachers. This study also identified that 22,250 secondary business teachers and 4,238 secondary marketing teachers were employed in 2007-2008 (U.S. Department of Education, 2008). For the purposes of this study, the marketing and business teachers will be combined into one category of 26,488 secondary teachers. Due to the large disbursement of the population across the country, online surveys were determined to be the most convenient to survey this population size (Van Selm & Jankowski, 2006).

Sample

The sample size for this study was determined by the G*Power 3 analysis. The G*Power analysis is recommended for univariate analysis, multivariate analyses of variance, survival analyses, and regression (Peng, Long, & Abaci, 2012). The sample size is determined using effect size (medium = 0.5), specified power, and alpha level (Kumar, Priyadarsini, & Ranganathan, 2018). Using the population size of 26,488 secondary business teachers, analysis results determined that the sample size was should contain at least 269 participants. Results from this study can be applied to decisions made by national, state, and district CTE administrators.

The sample represented secondary business teachers attending the Career and Technical Association of Texas Conference (CTAT) as well as secondary business teachers currently using social media groups on Twitter, Facebook, and LinkedIn. The CTAT summer conference included more than 1,000 CTE professionals (Career and Technical Association of

Texas, 2019). The following Facebook groups posted the online survey link: Social Media Marketing Education (718 members), Texas CTE Teacher Network (140 members), National Business Education Association (2,677 members), Business English Teachers (914 members), Business Educators (4,568 members), Association for Career and Technical Education (ACTE) (8,526 members), and New Tech High @ Coppell (482 members). The following Twitter accounts posted the online survey link: New Tech High @ Coppell (1,931 members) and New Tech High @ Coppell DECA (336 members). The following LinkedIn groups posted the online survey link: Socially Savvy Educators (143 members) and Association for Career and Technical Education (ACTE) (7,166 members). Membership in each of these platform groups is not mutually exclusive. The survey distribution aimed to cast a large net, even if duplicated, to get the attention of the targeted population. In addition, the survey link was distributed through email listservs from Career and Technical Student Organizations (DECA), online CTE forums on Facebook, and tweets to members of online CTE communities.

Data Collection

A convenience sample of secondary business teachers across the U.S. was gathered. The survey was created online using Qualtrics survey software. For the recruitment of potential respondents with special interests and attractiveness to a computer for ease of use (Van Selm & Jankowski, 2006), such as specific teaching areas, the use of online surveys may lead to higher response rates than pen and paper surveys.

The online survey quick response (QR) code and link were distributed at the Career and Technical Association of Texas (CTAT) Conference. CTAT attendees were given the QR code at the end of training presentations. The business career and technical student organization

(DECA) sent out an email to business advisors asking if they would like to take part in the research study. Posts with the survey link on Facebook, Twitter, and LinkedIn were targeting secondary teacher groups. The survey was open from July 16– August 23, 2019. Web-based surveys offer a benefit to participants (Van Selm & Jankowski, 2006) with the ability to respond at any time for an increased number of responses. All listserv email invitations were followed up with reminder email 7 days after the initial email.

July 16-19 – Texas CTE teachers (CTAT summer conference) attendees were given a QR code linked to the survey.

August 9 – Texas DECA Advisor listserv was sent an email link to the survey.

July 23-August 9 – Social media posts to online Secondary Business and CTE Communities were made weekly with an embedded link to the survey.

August 12 – Reminder email was sent to Texas DECA Advisor listserv.

August 23 – Survey was closed.

Instrumentation

The survey instrument for this study was modified from the original 21st Century Teaching and Learning Survey (Hixson et al., 2012). The instrument used in Hixson et al.'s study consists of four sections identifying the level of professional development (Items 4-7), use of PBL (Items 9-12), frequency of teaching 21st century skills (Items 14-47) and respondent demographics (Items 48-51). Hixson et al.'s (2012) survey instrument was based on the population's specific attendance of an extended professional development workshop focused on PBL. Contextual modifications were made to adapt the original instrument to the needs of the population in every section of the survey except for the frequency of teaching 21st century skills in Section 3. For example, the original survey asks, "Did you use PBL in your teaching of

core academic subjects – math, science, social studies or English?" This survey asks, "Did you use PBL in your teaching of business subjects-finance, accounting, economics, management, marketing, information technology, general business or entrepreneurship?" This change reflects the subjects taught by the target population.

The survey began with qualifying questions to ensure that the respondents represent the secondary business population (Items 1-3). The respondent was automatically redirected to exit the survey if not a secondary business teacher. The first section of the survey consisted of survey items that identified the respondent's level of professional development. Survey Items 4-7 queried the number of hours that the respondent was in professional development each year and the number of hours per year that were required from the respondent's school, school district, and state. Survey Item 8 determined if the focus of their professional development was on PBL. Questions in Section 1 were originally taken from Hixson (2012) and adapted by subject areas to meet the needs of CTE teachers. For the purposes of this study, overall time in professional development outside the time requirements of the state, district, and school were included.

PBL usage was examined in the second section of the survey. In addition to the changes in professional development-level questions, changes were made to the usage of PBL survey items in the second section of the survey. Survey Items 8-12 categorized the respondents by levels of PBL usage. Survey items were adapted from the original study to relate to CTE subject area covered. For example, the original survey asked "Did you use PBL in your teaching of core academic subjects – math, science, social studies, English?" (Hixson et al., 2012, p. 43). This survey asked "Did you use PBL in your teaching of business subjects-finance, accounting,

economics, management, marketing, information technology, general business, or entrepreneurship?" Survey Item 13 asked the respondents to select one target class. This target class is the business or marketing class in which the respondent feels their teaching using PBL was most effective. If their PBL use was equally effective in all of their classes or if they did not use PBL in any of their classes, the respondent is asked to pick any class perceived to have learned the most. The last Survey Item 12 in the second section categorizes the number of projects used by the teacher in the TARGET CLASS. The original survey uses the "target class" methodology in an examination of 21st century skills (Hixson et al., 2012).

The third section of the survey (Items 14-47) instrument consists of 34 questions focused on four defined 21st century skills. These skill survey items were created by Ravitz (2014). The items were not changed from the Ravitz (2014) survey. The 21st Century Teaching and Learning survey includes items intended to measure the following 21st century skills: critical thinking (9 items), collaboration (9 items), communication (8 items), creativity and innovation (8 items).

> Each 21st century skill subsection provides (1) the above definition, (2) a list of related practices, and (3) questions about perceptions. After each definition the survey asks about the frequency of 5 to 8 practices pertaining to that skill (e.g., having students work in groups to support collaboration). Response choices were 1 'Almost never'; 2 'A few times a semester'; 3 '1-3 times per month'; 4 '1-3 times per week'; 5 'Almost daily'. In addition to the frequency of different practices, Ravitz (2014) asked how much teachers perceive having taught and assessed each skill, using critical thinking as an example: (a) I have tried to develop students' critical thinking skills; (b) Most students have learned critical thinking skills while in my class; and, (c) I have been able to effectively assess students' critical thinking skills. Response choices were 1 'Not really'; 2 'To a minor extent'; 3 'To a moderate extent'; 4 'To a great extent', 5 'To a very great extent' (Ravitz, 2014, p.2).

The fourth section of the survey asks respondents to answer four demographic questions. Demographic question placement within a survey is an important factor (Teclaw,

Price, & Osatuke, 2012). Demographic questions are placed at the end of the survey to avoid alienating respondents with questions that seem irrelevant to research goals (DeFranzo, 2012). Survey Items 48-51 identify respondent's years of teaching, age, gender, and ethnicity. These demographic questions are used to further analyze the defined groups within the survey.

Data Analysis

The data is analyzed using IBM® Statistical Packages for Social Sciences Version 26 (SPSS®). The data uses the mean scores of PBL usage, time spent in professional development, and 21st century skill teaching sections of the survey. Each 21st century skill was broken down into two parts; classroom practice and teacher reflection. Classroom practice questions connect the actual practice to the skill. Teacher reflection questions connect the teachers' perception of the effectiveness of their practices to teaching 21st century skills (Davis, 2018). A total PBL usage score will be calculated by combining all of the answers from the PBL section of the survey. A two-tailed bivariate correlational analysis was conducted to measure the relationship between the use of PBL and the teaching of 21st century skills for Hypothesis 1.

The second research question investigates the relationship between time spent in professional development and the teaching of critical thinking, collaboration, communication, creativity, and innovation skills. A professional development score is calculated by combining all of the answers from the professional development section of the survey. A two-tailed bivariate correlational analysis was conducted to measure the relationship between time spent in professional development and the teaching of 21st century skills for Hypothesis 2.

Research Question 3 uses a regression analysis to test to determine statistically how likely it is that the use of project-based learning and time spent in professional development

could predict the teaching of 21st century skills under similar circumstances. Predicted possibilities provide practitioners with basic information about how the variables could be forecasted in similar situations to illustrate how responsive the behavior could be in a given variable.

Table 3

Research Hypothesis Analysis and Variable Types

Hypothesis	Data Analysis	Variable	Type
H1	Pearson Correlation	PBL Usage	IV
		Teaching 21st Century Skills	DV
H2	Pearson Correlation	Time spent in Professional Development	IV
		Teaching 21st Century Skills	DV
H3	Regression	Time spent in Professional Development	IV
		PBL Usage	IV
		Teaching 21st Century Skills	DV

Summary

This chapter discussed research design, population and sampling, instrumentation, data collection, and data analysis. This study used non-experimental survey research to determine if extended professional development and PBL increased the teaching of 21st century skills for secondary business teachers. The online survey was distributed at a wide audience through social media and at a targeted conference. The data collected is analyzed in the next chapter.

CHAPTER 4

RESULTS

The purpose of this study was to examine the relationships between using project-based learning (PBL) and time spent in professional development on the teaching of 21st century skills. The study also sought to discover evidence that an increase in the use of PBL and time spent in professional development could increase the teaching of 21st century skills. This chapter provides information on the sample size, procedures, hypothesis testing, and summary.

Participants

A total of 382 surveys were completed between July 16-August 23, 2019. Participants that did not teach in the U. S. (*n* = 22) along with participants that did not fully complete the survey (*n* = 44) were excluded from study. After removing these exclusions, 316 useable surveys were collected, representing an 83% response rate (*N* = 316). Table 4 reports the demographics of the sample.

Table 4

Demographics

Demographic Variable		n	%
Gender	Male	50	16%
	Female	266	84%
	Total	316	100%
Age	25-34 Years	60	19%
	35-44 Years	119	38%
	45-54 Years	100	32%
	55 and Older	37	12%
	Total	316	100%

(table continues)

Demographic Variable		n	%
Years of Experience	0-2 Years	22	7%
	3-5 Years	56	18%
	5-10 Years	64	20%
	More than 10 Years	174	55%
	Total	316	100%

Procedures

Organized by hypothesis, this section discussed how the data was analyzed.

Hypothesis 1

H_o1: There is no statistically significant relationship between using PBL and teaching 21st century skills in secondary business education.

Each of the four 21st century skills divided into categories of classroom practice and teacher reflection was measured for correlation with usage of PBL by secondary business teachers.

The critical thinking variables, classroom practice and teacher reflection show a relationship with total PBL scores. Scatterplots in Figure 2 and Figure 3 indicate that an increase in total PBL score could lead to an increase in both critical thinking variables. Due to the visible trends in these figures, a Pearson correlation coefficient was calculated for additional analysis ($\alpha = .05$).

The calculations for the correlational coefficient indicate PBL scores and both Critical thinking skills variables are statistically significant. The bivariate Pearson product-moment correlation coefficient of PBL scores and classroom practice of critical thinking skills revealed a significant positive correlation ($r = .429$, $p < .01$). An r^2 of 0.184 signified that approximately

18.4% of the variance in the classroom practice of critical thinking skills is due to its linear relationship with PBL scores. In addition, the Pearson product-moment correlation coefficient for PBL scores and teacher reflection of critical thinking skills revealed a significant positive correlation (r = .436, p < .01). An r^2 of 0.190 signified that approximately 19% of the variance in the teacher reflection of critical thinking skills is due to its linear relationship with PBL scores.

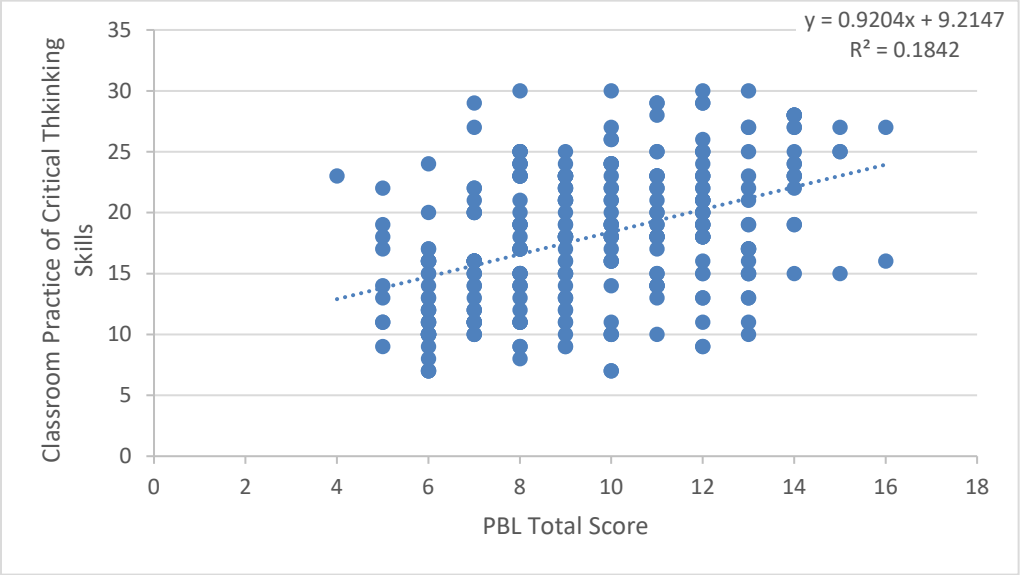

Figure 2. Scatterplot of PBL scores and classroom practice of critical thinking skills.

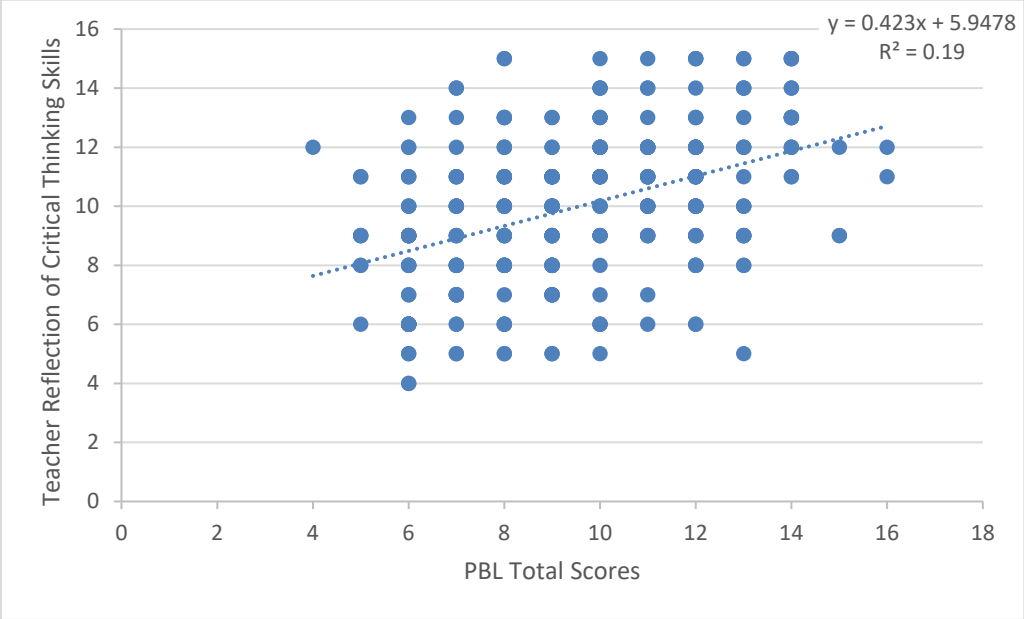

Figure 3. Scatterplot of PBL scores and teacher reflection of critical thinking skills.

Table 5

Correlation of PBL Total Scores and Critical Thinking Skills

	Critical Thinking Skills Classroom Practice	Critical Thinking Skills Teacher Reflection
Pearson Correlation (*r)*	.429	.436
Sig. (2-tailed)	<.01	<.01
N	316	316

A post hoc power analysis was conducted to assess whether the statistical test had a fair chance to reject an incorrect H_o (Faul, Erdfelder, Lang, & Buchner, 2007). Cohen's power table (1988) (Appendix B) lists statistical power for the correlation between classroom practice of critical thinking skills and PBL score (r = .429, N = 316) was .99. The statistical power for correlation between teacher reflection of critical thinking skills (r = .436, N = 316) was .99. For both null hypotheses, the Type I error ($1 - \beta$) revealed a 99% chance of rejecting the null hypothesis when it is false. For both null hypotheses, the Type II error showed 1% chance of non-rejection of a false null hypothesis ($\beta = 1 - P$).

The collaboration skill variables, classroom practice and teacher reflection, show a relationship with total PBL scores. Scatterplots in Figure 4 and Figure 5 indicate an increase in total PBL score could lead to an increase in both collaboration variables. Due to the visible trends above, a Pearson correlation coefficient was calculated for additional analysis (α = .05).

The calculations for the correlational coefficient indicate PBL scores and both collaboration skills variables are statistically significant. The bivariate Pearson product-moment correlation coefficient of PBL scores and classroom practice of collaboration skills revealed a significant positive correlation (r = .441, $p < .01$). An r^2 of 0.194 signified that approximately

19.45% of the variance in the classroom practice of collaboration skills is due to its linear relationship with PBL scores. In addition, the Pearson product-moment correlation coefficient for PBL scores and teacher reflection of collaboration skills revealed a significant positive correlation (r = .407, p < .01). An r^2 of 0.165 signified that approximately 16.56% of the variance in the teacher reflection of collaboration skills is due to its linear relationship with PBL scores.

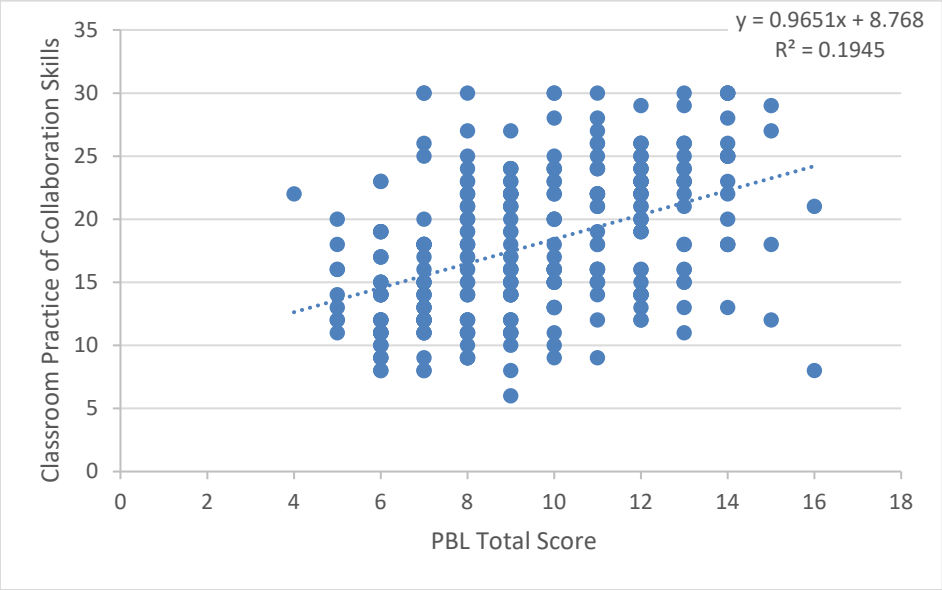

Figure 4. Scatterplot of PBL scores and classroom practice of collaboration skills.

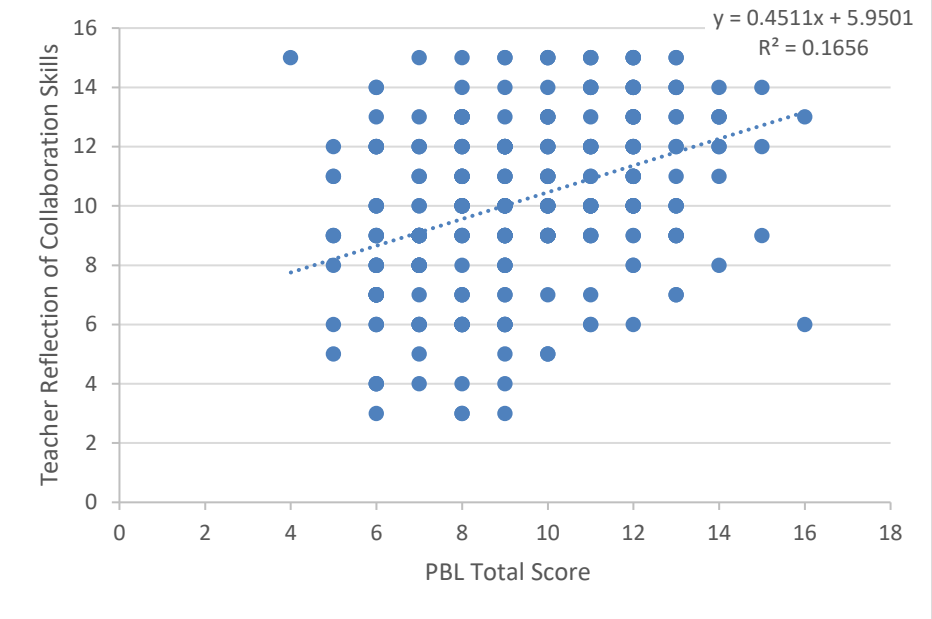

Figure 5. Scatterplot of PBL scores and teacher reflection of collaboration skills.

Table 6

Correlation of PBL Total Scores and Collaboration Skills

	Collaboration Skills Classroom Practice	Collaboration Skills Teacher Reflection
Pearson Correlation (*r)*	.441	.407
Sig. (2-tailed)	<.01	<.01
N	316	316

A post hoc power analysis was conducted to assess whether the statistical test had a fair chance to reject an incorrect H_o (Faul et al., 2007). Cohen's power table (1988) (Appendix B) lists statistical power for the correlation between classroom practice of collaboration skills and PBL score (r = .441, N = 316) was .99. The statistical power for correlation between teacher reflection of collaboration skills (r = .407, N = 316) was .99. For both null hypotheses, the Type I error ($1 - \beta$) revealed a 99% chance of rejecting the null hypothesis when it is false. For both null hypotheses, the Type II error showed 1% chance of non-rejection of a false null hypothesis ($\beta = 1 - P$).

The communication skill variables, classroom practice and teacher reflection, show a relationship with total PBL scores. Scatterplots in Figures 6 and 7 indicate an increase in total PBL score could lead to an increase in both Communication Skill variables. Due to the visible trends above, a Pearson correlation coefficient was calculated for additional analysis (α = .05).

The calculations for the correlational coefficient indicate PBL scores and both communication skills variables are statistically significant. The bivariate Pearson product-moment correlation coefficient of PBL scores and classroom practice of communication skills revealed a significant positive correlation (r = .399, $p < .01$). An r^2 of 0.159 signified that

approximately 15.92% of the variance in the classroom practice of communication skills is due to its linear relationship with PBL scores. In addition, the Pearson product-moment correlation coefficient for PBL scores and teacher reflection of communication skills revealed a significant positive correlation (r = .382, p < .01). An r^2 of 0.147 signified that approximately 14.75% of the variance in the teacher reflection of communication skills is due to its linear relationship with PBL scores.

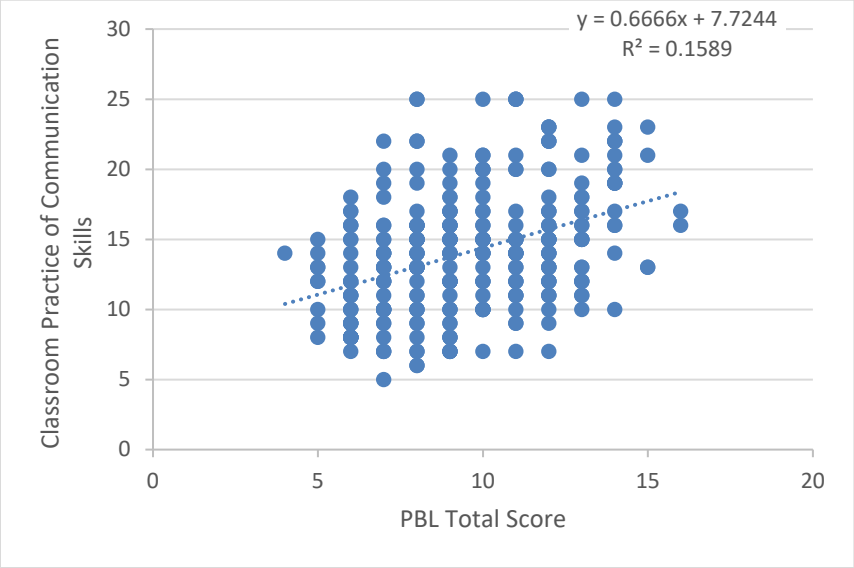

Figure 6. Scatterplot of PBL scores and classroom practice of communication skills.

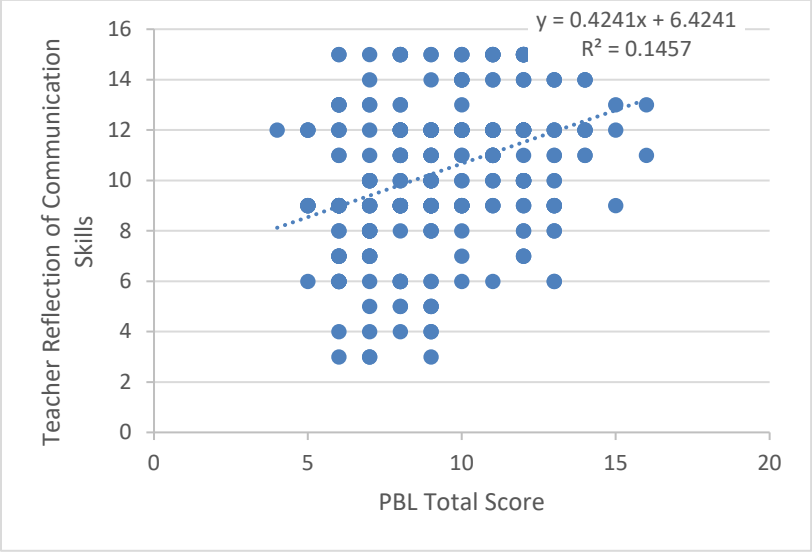

Figure 7. Scatterplot of PBL scores and teacher reflection of communication skills.

Table 7

Correlation of PBL Total Scores and Communication Skills

	Communication Skills Classroom Practice	Communication Skills Teacher Reflection
Pearson Correlation (r)	.399	.382
Sig. (2-tailed)	<.01	<.01
N	316	316

A post hoc power analysis was conducted to assess whether the statistical test had a fair chance to reject an incorrect H_o (Faul et al., 2007). Cohen's power table (1988) (Appendix B) lists statistical power for the correlation between classroom practice of communication skills and PBL score (r = .399, N = 316) was .99. The statistical power for correlation between teacher reflection of communication skills (r = .382, N = 316) was .99. For both null hypotheses, the Type I error (1 – β) revealed a 99% chance of rejecting the null hypothesis when it is false. For both null hypotheses, the Type II error showed 1% chance of non-rejection of a false null hypothesis (β = 1 – P).

The creativity and innovation skill variables, classroom practice and teacher reflection, show a relationship with total PBL scores. Scatterplots in Figure 8 and Figure 9 indicate an increase in total PBL score could lead to an increase in both Creativity and Innovation Skill variables. Due to the visible trends above, a Pearson correlation coefficient was calculated for additional analysis (α = .05).

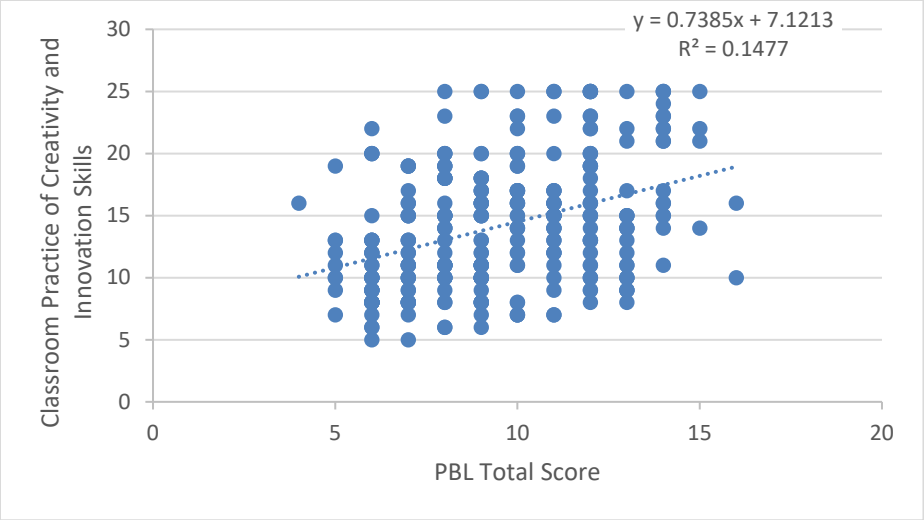

Figure 8. Scatterplot of PBL scores and classroom practice of creativity and innovation skills.

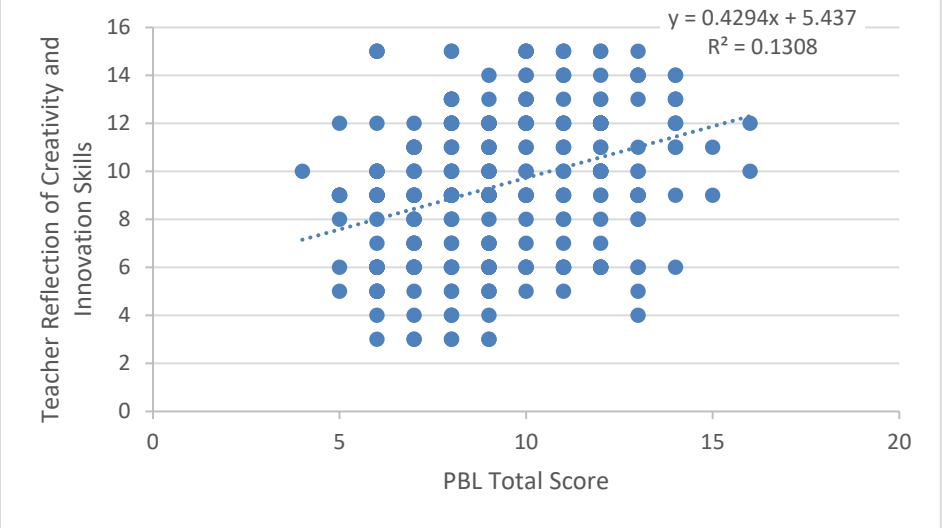

Figure 9. Scatterplot of PBL scores and teacher reflection of creativity and innovation skills.

The calculations for the correlational coefficient indicate PBL scores and both creativity and innovation skill variables are statistically significant. The bivariate Pearson product-moment correlation coefficient of PBL scores and classroom practice of creativity and innovation skills revealed a significant positive correlation ($r = .384$, $p < .01$). An r^2 of 0.147 signified that approximately 14.75% of the variance in the classroom practice of creativity and innovation skills is due to its linear relationship with PBL scores. In addition, the Pearson product-moment correlation coefficient for PBL scores and teacher reflection of creativity and

innovation skills revealed a significant positive correlation (r = .362, p < .01). An r^2 of 0.131signified that approximately 13.1% of the variance in the teacher reflection of creativity and innovation skills is due to its linear relationship with PBL scores.

Table 8

Correlation of PBL Total Scores and Creativity and Innovation Skills

	Creativity and Innovation Skills Classroom Practice	Creativity and Innovation Skills Teacher Reflection
Pearson Correlation (*r)*	.384	.362
Sig. (2-tailed)	<.01	<.01
N	316	316

A post hoc power analysis was conducted to assess whether the statistical test had a fair chance to reject an incorrect H_o (Faul et al., 2007). Cohen's power table (1988) (Appendix B) lists statistical power for the correlation between classroom practice of creativity and innovation skills and PBL score (r = .441, N = 316) was .99. The statistical power for correlation between teacher reflection of creativity and innovation skills (r = .407, N = 316) was .99. For both null hypotheses, the Type I error (1 – β) revealed a 99% chance of rejecting the null hypothesis when it is false. For both null hypotheses, the Type II error showed 1% chance of non-rejection of a false null hypothesis (β = 1 – P).

The data supports the rejection of the null hypothesis, that there is not a significant relationship between using PBL and teaching 21st century skills. This was seen through the statistical analysis of using PBL and each of the four 21st century skills selected for review in the study. The use of PBL had a positive impact on both the classroom practice and teacher reflection of critical thinking skills, collaboration, communication and creativity and innovation.

All correlations that were calculated were positive indicating that as teachers used more PBL, they also increased their teaching of critical thinking, collaboration, communication, creativity and innovation.

Hypothesis 2

H_o2: There is no statistically significant difference between time spent in professional development and teaching 21st century skills in secondary business education.

Each of the four 21st century skills were measured for correlation with time spent in professional development (PD) for secondary business teachers.

The critical thinking skill variables, classroom practice and teacher reflection, show a relationship with time spent in professional development. The scatterplot in Figure 10 indicates that as time spent in professional development increases the classroom practice of critical thinking skills could decrease making this a negative correlation. The scatterplot in Figure 11 indicates that as time spent in professional development increases, the teacher reflection of critical thinking skills could increase making this a positive correlation. A Pearson correlation coefficient was calculated for additional analysis.

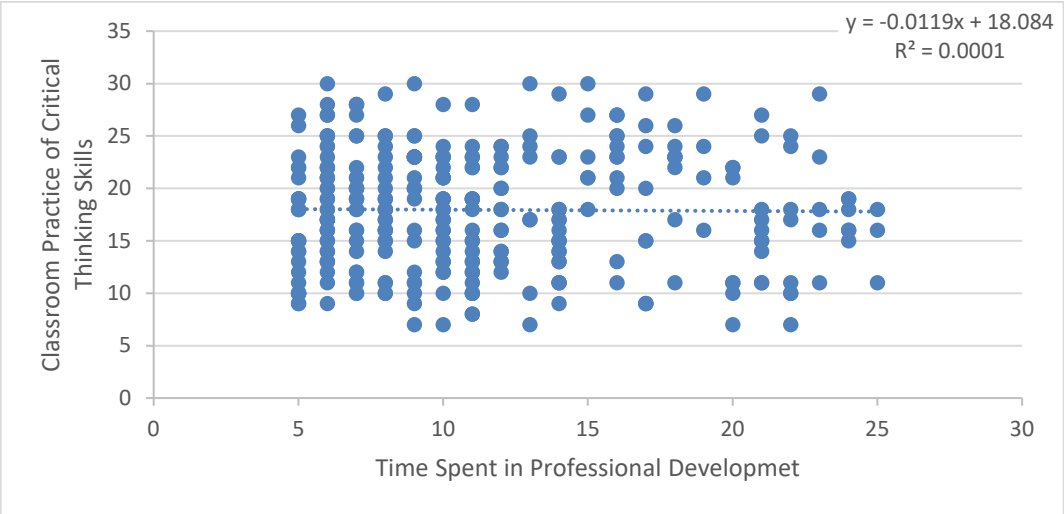

Figure 10. Scatterplot of time spent in PD and classroom practice of critical thinking skills.

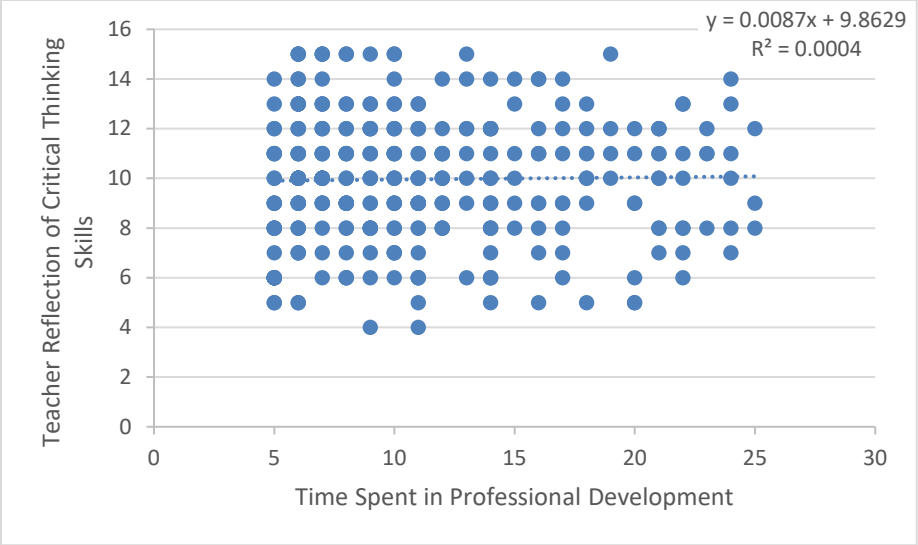

Figure 11. Scatterplot of time spent in PD and teacher reflection of critical thinking skills.

Table 9

Correlation of Time Spent in PD and Critical Thinking Skills

	Critical Thinking Skills Classroom Practice	Critical Thinking Skills Teacher Reflection
Pearson Correlation (*r)*	-.012	.019
Sig. (2-tailed)	.838	.740
N	316	316

The calculations for the correlational coefficient do not indicate a statistically significant correlation between time spent in professional development and both critical thinking skill variables. The correlational analysis reveals that time spent in professional development with classroom practice of critical thinking skills (r = -.012, p = .838) and with teacher reflection of critical thinking skills (r = .019, p = .740). The study failed to reject the null hypothesis. There is not a significant relationship between time spent in professional development and both critical thinking skill variables.

The collaboration skill variables, classroom practice and teacher reflection, show a relationship with time spent in professional development. The scatterplot in Figure 12 indicates that as time spent in professional development increases, the classroom practice of collaboration skills could increase, making this a positive correlation. The scatterplot in Figure 13 indicates that as time spent in professional development increases, the teacher reflection of collaboration skills increases making this a positive correlation. A Pearson correlation coefficient was calculated for additional analysis.

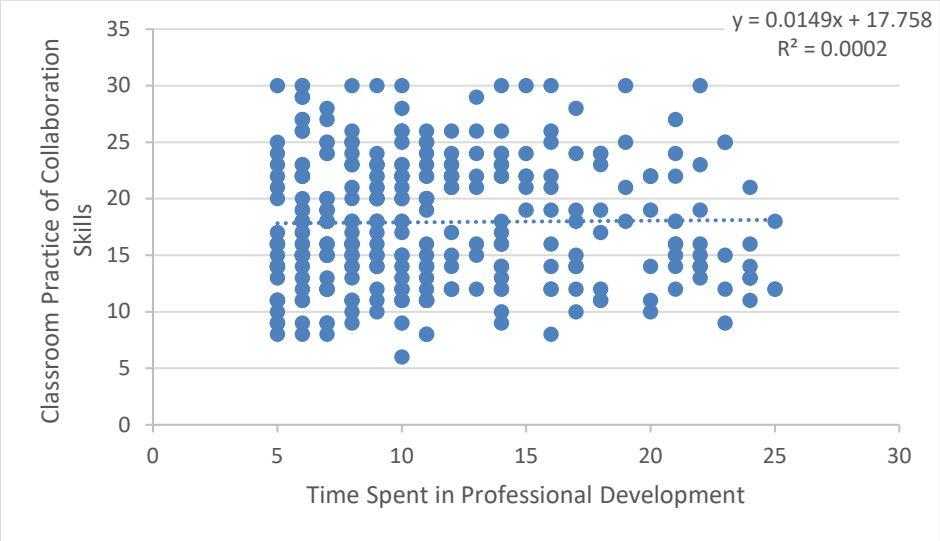

Figure 12. Scatterplot of time spent in PD and classroom practice of collaboration skills.

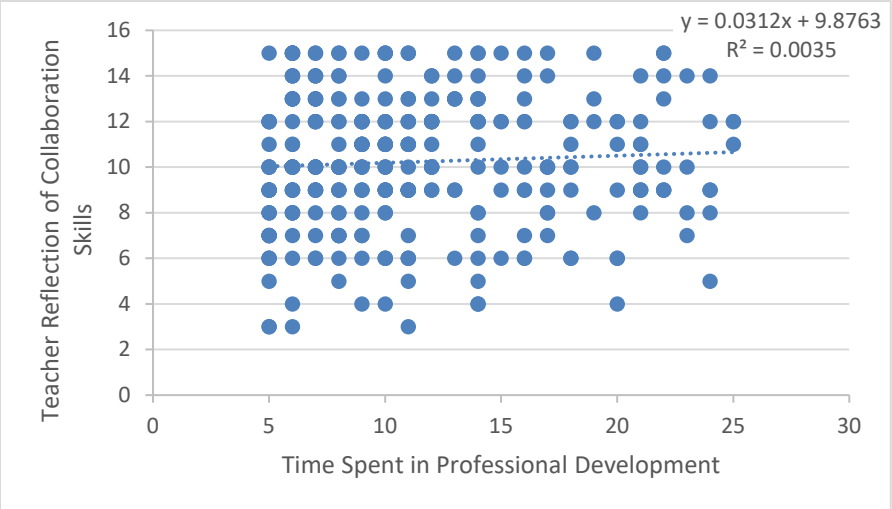

Figure 13. Scatterplot of time spent in PD and teacher reflection of collaboration skills.

Table 10

Correlation of Time Spent in PD and Collaboration Skills

	Collaboration Skills Classroom Practice	Collaboration Skills Teacher Reflection
Pearson Correlation (*r)*	.014	.059
Sig. (2-tailed)	.801	.297
N	316	316

The calculations for the correlational coefficient do not indicate correlation between time spent in professional development and both collaboration skills. The bivariate Pearson product-moment correlation coefficient of PBL scores and classroom practice of collaboration skills (r = .014, p = .801) and teacher reflection of collaboration skills (r = .059, p = .297) did not revealed a significant positive correlation. This analysis failed to reject the null hypothesis. There is not a significant relationship between time spent in professional development and both collaboration skill variables.

The communication skill variables, classroom practice and teacher reflection, show a relationship with time spent in professional development. The scatterplot in Figure 14 indicates that as time spent in professional development increases, the classroom practice of communication skills could increase making this a positive correlation. The scatterplot in Figure 15 indicates that as time spent in professional development increases, the teacher reflection of communication skills could increase making this a positive correlation. A Pearson correlation coefficient was calculated for additional analysis.

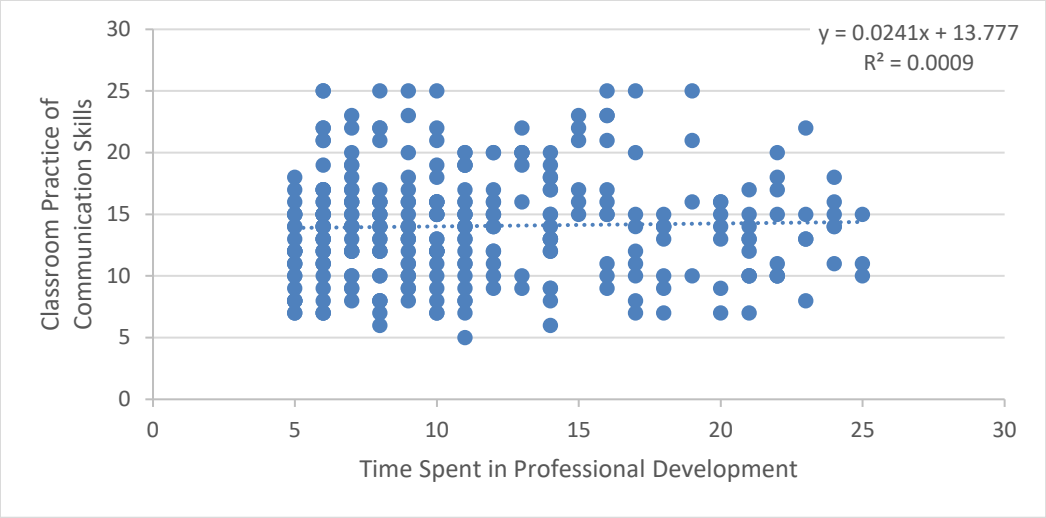

Figure 14. Scatterplot of time spent in PD and classroom practice of communication skills.

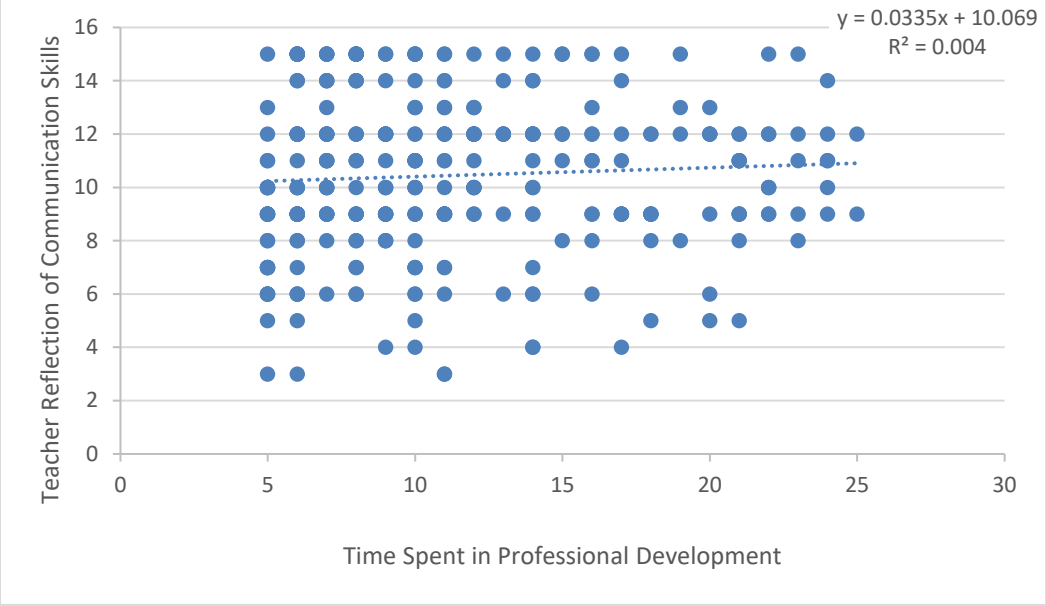

Figure 15. Scatterplot of time spent in PD and teacher reflection of communication skills.

Table 11

Correlation of Time Spent in PD and Communication Skills

	Communication Skills Classroom Practice	Communication Skills Teacher Reflection
Pearson Correlation (*r*)	.030	.063
Sig. (2-tailed)	.595	.265
N	316	316

The calculations for the correlational coefficient do not indicate a statistical correlation between time spent in professional development and both communication skills. The bivariate Pearson product-moment correlation coefficient of PBL scores and classroom practice of communication skills (r = .030, p = .595) and teacher reflection of communication skills (r = .063, p = .265) did not revealed a significant positive correlation. This analysis failed to reject the null hypothesis. There is not a significant relationship between time spent in professional development and both communication skill variables.

The creativity and innovation skill variables, classroom practice and teacher reflection, show a relationship with time spent in professional development. The scatterplot in Figure 16 indicates that as time spent in professional development increases, the classroom practice of creativity and innovation skills could increase making this a positive correlation. The scatterplot in Figure 17 indicates that as time spent in professional development increases, the teacher reflection of creativity and innovation skills could increase making this a positive correlation. A Pearson correlation coefficient was calculated for additional analysis.

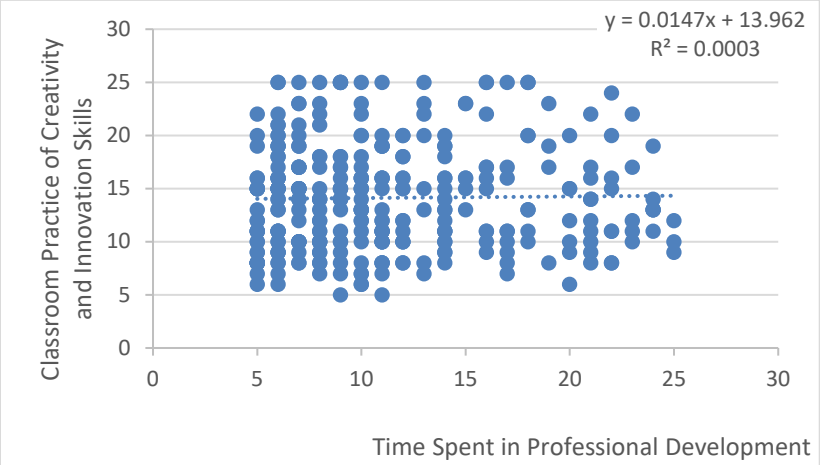

Figure 16. Scatterplot of time spent in PD and classroom practice of creativity and innovation skills.

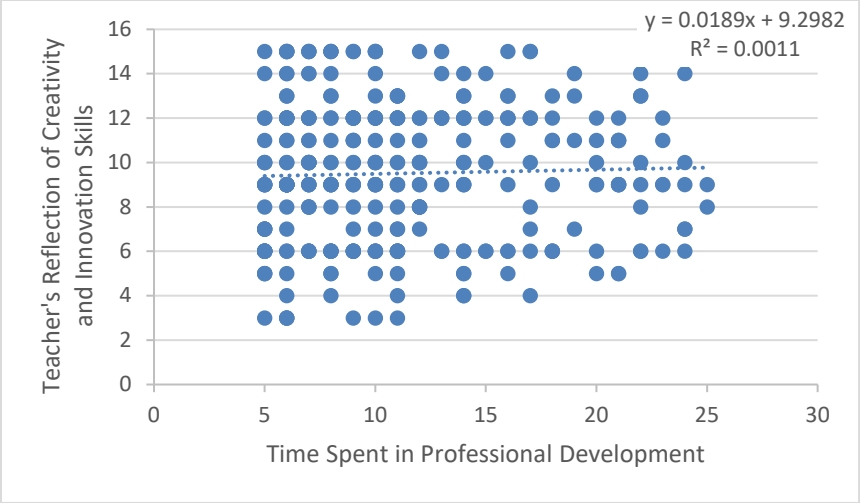

Figure 17. Scatterplot of time spent in PD and teacher reflection of creativity and innovation skills.

Table 12

Correlation of Time Spent in PD and Creativity and Innovation Skills

	Creativity and Innovation Skills Classroom Practice	Creativity and Innovation Skills Teacher Reflection
Pearson Correlation (*r)*	.016	.033
Sig. (2-tailed)	.777	.557
N	316	316

The calculations for the correlational coefficient do not indicate a statistical correlation between time spent in professional development and both creativity and innovation skills. The bivariate Pearson product-moment correlation coefficient of PBL scores and classroom practice of creativity and innovation skills (r = .016, p = .777) and teacher reflection of creativity and innovation skills (r = .033, p = .557) did not revealed a significant positive correlation. This analysis failed to reject the null hypothesis. There is not a significant relationship between time spent in professional development and both creativity and innovation skill variables.

The data has shown there is not a statistically significant difference between time spent in professional development and teaching 21st century skills in secondary business education.

The research failed to reject the second null hypothesis across all of the four 21st century skills.

Hypothesis 3

H_o3: There is no statistically significant interaction between using PBL and time spent in professional development on teaching 21st century skills in the secondary business education classroom.

A multiple linear regression was conducted to determine if using PBL and time spent on professional development increase the teaching of 21st century skills. The findings of the multiple linear regression analysis revealed that the linear combination of using PBL was significantly related to the teaching of critical thinking skills, (p = 4.65E-17, p > .01). Since the p-value is less than (α = .05), the analysis shows that the PBL score was significantly associated with the critical thinking score. The findings of the multiple linear regression analysis revealed that linear combination of time spent in professional development was not significantly related to the teaching of critical thinking skills, (p = .87, < .05). Since the p-value is greater than (α = .05), the analysis shows time spent in professional development did not significantly associate with the critical thinking score. The same multiple correlation coefficient was R = .46 with an R^2 of .21, indicating that approximately 21% of the variance of teaching critical thinking skills is explained by the use of PBL and time spent in professional development. For every one unit increase in PBL score, the critical thinking score will increase by 1.36.

Critical Thinking Skills = 15.11 + 1.36*PBL Score

The findings of the multiple linear regression analysis revealed that the linear combination of using PBL was significantly related to the teaching of critical thinking skills, (p = 4.77E-18, p > .01). Since the p-value is less than (α = .05), the analysis shows the PBL score did significantly associate with the critical thinking score. The findings of the multiple linear

regression analysis revealed that linear combination of time spent in professional development was not significantly related to the teaching of critical thinking skills, (p = .62, < .05). Since the p-value is greater than (α = .05), there is not sufficient evidence that the time spent in professional development is a significant association of the critical thinking score. The same multiple correlation coefficient was R = .46 with an R^2 of .21, indicating that approximately 21% of the variance of teaching critical thinking skills is explained by the use of PBL and time spent in professional development. For every one unit increase in PBL score, the critical thinking skills score will increase by 1.36.

Collaboration Skills = 14.01 + 1.46*PBL Score

The findings of the multiple linear regression analysis revealed that the linear combination of using PBL was significantly related to the teaching of communication skills, (p = 5.32E-15, p > .01). Since the p-value is less than (α = .05), there is sufficient evidence that the PBL score is a significantly associated with the communication score. The findings of the multiple linear regression analysis revealed that linear combination of time spent in professional development was not significantly related to the teaching of communication skills, (p = .43, < .05). Since the p-value is greater than (α = .05), there is not sufficient evidence that the time spent in professional development is a significantly associated with the communication skills score. The same multiple correlation coefficient was R = .42 with an R^2 of .18, indicating that approximately 18% of the variance of teaching communication skills is explained by the use of PBL and time spent in professional development. For every one unit increase in PBL score, the communication skills score will increase by 1.30.

Communication Skills = 13.48 + 1.10*PBL Score

The findings of the multiple linear regression analysis revealed that the linear combination of using PBL was significantly related to the teaching of creativity and innovation skills, (p = 7.40E-14, p > .01). Since the p-value is less than (α = .05), there is sufficient evidence that the PBL score is a significant associated with the creativity and innovation skills score. The findings of the multiple linear regression analysis revealed that the linear combination of time spent in professional development was not significantly related to the teaching of creativity and innovation skills, (p = .72, < .05). Since the p-value is greater than (α = .05), there is not sufficient evidence that the time spent in professional development is a significantly associated with the creativity and innovation skills score. The same multiple correlation coefficient was R = .41 with an R^2 of .16, indicating that approximately 16% of the variance of teaching creativity and innovation skills is explained by the use of PBL and time spent in professional development. For every one unit increase in PBL score, the creativity and innovation skills score will increase by 1.18.

Creativity and Innovation Skills = 12.15 + 1.18*PBL Score

There was sufficient evidence that the PBL score is a significantly associated with teaching 21st century skills. The evidence does not support that time spent in professional development is a significantly associated with teaching 21st century skills.

Summary

This chapter addressed the data collected and statistical tests performed including bivariate analysis and multiple linear regression. The null Hypothesis 1 was rejected across four of the 21st century skills based on the analysis of the data. The results showed that there is a statistically significant relationship between using PBL and teaching 21st century skills. The null

Hypothesis 2 failed to reject across four of the 21st century skills. The data has shown there is not a statistically significant difference between time spent in professional development and teaching 21st century skills in secondary business education. The null Hypothesis 3 was rejected for the linear combination of using PBL to cause a significant variance in teaching 21st century skills. The null Hypothesis 3 failed to reject for the linear combination of time spent in professional development to cause a significant variance in teaching 21st century skills. The regression analysis did not show time spent in professional development to be a significantly associated with teaching 21st century skills.

CHAPTER 5

FINDINGS, CONCLUSIONS, AND RECOMMENDATIONS

This chapter discusses the data analysis presented in the previous chapter. This research was conducted to reveal relationships, if any, between using project-based learning (PBL) and time spent in professional development on the teaching of 21st century skills. This chapter includes the findings of each hypothesis, conclusions drawn from the data analysis, and recommendations for future studies.

Findings and Conclusions

H_o1: There is no statistically significant relationship between using PBL and teaching 21st century skills in secondary business education.

The analysis in this study determined that a significant correlation was found between secondary business teachers' use of PBL and teaching 21st century skills. This determination is not surprising given similar findings from other researchers (Hixson et al., 2012; Ravitz et al., 2012; Tanner, 2012). This study adds a new correlational finding to the existing literature on PBL and the teaching of 21st century skills and how the two constructs are related. In addition, this new correlation finding adds to the research for the advancement of secondary business education.

The statistical correlations found could indicate that as teachers use more PBL, teachers could increase the teaching of critical thinking, collaboration, communication, creativity and innovation skills. Teachers should strive to develop scenario-based projects that teach course objectives while incorporating 21st skills. Project ideas can come from real companies or web-based searches. Teachers use online social media websites (e.g. Facebook, Instagram, Pinterest)

to share project ideas. Projects should include 21st century skills through scaffolding them throughout the project or including them in the grading rubric. For example, students could work on a group project that requires them to create a business plan. Throughout the project, students could review sections of their plan with other groups in the class to facilitate collaboration. The end product of the business plan project could have an overall grade based on knowledge within the business plan and a grade for the communication of their business plan to an outside panel of business professionals. These added processes encourage students to seek skills beyond creating a final product.

H_o2: There is no statistically significant difference between time spent in professional development and teaching 21st century skills in secondary business education.

In this study, a significant statistical correlation was not found between time spent in professional development and teaching 21st century skills in secondary business education. This lack of correlation does not align with the same conclusions found in earlier hypothesis testing (Hixson et al., 2012; Ravitz et al., 2012). This finding could have been due to the fact that professional development was typically not offered on teaching 21st century skills. Teachers should be spending time in professional development on other topics.

While spending time in professional development is critical to the successful implementation of PBL, teachers must also be personally invested in professional development (Fallik, Eylon, & Rosenfeld, 2008). Administrators and career and technical education (CTE) directors should find ways to motivate, and perhaps incentivize, the use of PBL in the classroom. Districts or schools can use professional development days to hold a project creation competition. Teachers could be put into groups and tasked with creating a high-quality project that incorporates 21st century skills and course content. At the end of the professional

development day, groups present their ideas to all of the groups. This professional development idea allows teachers to use critical thinking, collaboration, communication, creativity and innovation as they create the projects for their classrooms. In addition to hands on professional development, policies can be enacted by schools and districts to document the use of PBL for the teaching of critical thinking, collaboration, communication, creativity, and innovation skills.

> *H_o3: There is no statistically significant interaction between using PBL and time spent in professional development on teaching 21st century skills in the secondary business education classroom.*

The analysis in this study used multiple linear regression to determine how well using PBL and time spent in professional development might explain the variance in teaching 21st century skills. While the overall regression model showed the linear combination of using PBL and time spent in professional development caused significant variance in teaching 21st century skills, it did not significantly associate time spent in professional development with the teaching of 21st century skills. Throughout the regression analysis, sufficient evidence was found to indicate that PBL was significantly associated with the teaching critical thinking, collaboration, communication, creativity, and innovation.

A possible explanation for the study's conclusions could be that professional development offered to the teachers is not focused on teaching 21st century skills. Professional development needs for the teachers are often focused on accountability standards in addition to teaching 21st century skills (Brathwaite, 2011). Teachers might not be personally motivated to implement the teachings of professional development in their classrooms (Fallik et al., 2008). Rotherham and Willingham (2010) argue that without robust professional development in

evidence-based teaching methods, teachers do not have the proper support to implement the teaching of 21st century skills. In order for professional development to impact the teaching of 21st century skills, the teacher and administrators must see the importance in 21st century skills for the classroom.

Recommendations

Implementing innovative practices, such as project-based and scenario-based learning, into classrooms is often a goal of all educational reform. The findings from this study recommended that business education should implement the use of project-based learning. Implementation of this teaching methodology requires national, state, district, and school administrator support. Educational reform decisions are often top-down choices made with input from current classroom teachers (Fullan, 2015). This top-down process assumes that administrators and teachers agree in their beliefs towards the implementation of the reform for that reform to be successful. According to Fullan (2016), a large part of the educational-change problem comes from the difficulties related to planning for the change in teaching methods. Implementation consists of the process of putting into practice an idea, program, or set of activities and structures that are new to the people attempting or expected to change (p. 67). Fullan's traditional model of change includes three phases: 1) initiation 2) implementation 3) continuation. The initiation process includes decisions leading up to the initial adoption of the change. The implementation process involves teachers attempting to put the idea into practice. Continuation is the final stage that refers to whether the change gets built-in to the system (p.55) or not. This implementation process is essential to the full adoption of project-based learning as a teaching methodology.

Future research studies should focus on the usage of PBL in other career and technical education (CTE) subject areas (e.g. health science, law and public safety, agriculture, etc.). The research could investigate the impact of specific PBL trainings on the teaching of 21st century skills. Practical application of the findings suggest that teachers should be encouraged to use PBL in the business education classroom. Teachers should create or try to find project-based projects that fit into the teaching of required course objectives.

APPENDIX A

INSTITUTIONAL REVIEW BOARD APPROVAL LETTER

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THE OFFICE OF RESEARCH AND INNOVATION
Research and Economic Development

July 12, 2019

PI: Jeffrey Allen
Study Title: TEACHING 21ST CENTURY SKILLS THROUGH PROJECT-BASED LEARNING AND EXTENDED PROFESSIONAL DEVELOPMENT: A SURVEY OF SECONDARY BUSINESS EDUCATORS

RE: Human Subjects Application # IRB-19-411

Dear Dr. Jeffrey Allen:

In accordance with 45 CFR Part 46 Section 46.104, your study titled "TEACHING 21ST CENTURY SKILLS THROUGH PROJECT-BASED LEARNING AND EXTENDED PROFESSIONAL DEVELOPMENT: A SURVEY OF SECONDARY BUSINESS EDUCATORS " has been determined to qualify for an exemption from further review by the UNT Institutional Review Board (IRB).

Attached to your IRB application in the Study Detail section under the Attachments tab are the consent documents with IRB approval. Since you are conducting an online study, **please copy the approved language and paste onto the first page of your online survey. You may also use the enclosed stamped document as the first page of your online survey.**

No changes may be made to your study's procedures or forms without prior written approval from the UNT IRB. Please contact The Office of Research Integrity and Compliance at 940-565-4643 if you wish to make any such changes. Any changes to your procedures or forms after 3 years will require completion of a new IRB application.

We wish you success with your study.

Sincerely,

APPENDIX B

POWER TABLES FOR EFFECT SIZE *r*

Power Tables for Effect Size r

(from Cohen 1988, pg. 102)

two-tailed α = .05 or one-tailed α = .025

	r								
Power	**.10**	**.20**	**.30**	**.40**	**.50**	**.60**	**.70**	**.80**	**.90**
.25	167	42	20	12	8	6	5	4	3
.50	385	96	42	24	15	10	7	6	4
.60	490	122	53	29	18	12	9	6	5
2/3	570	142	63	34	21	14	10	7	5
.70	616	153	67	37	23	15	10	7	5
.75	692	172	75	41	25	17	11	8	6
.80	783	194	85	46	28	18	12	9	6
.85	895	221	97	52	32	21	14	10	6
.90	1047	259	113	62	37	24	16	11	7
.95	1294	319	139	75	46	30	19	13	8
.99	1828	450	195	105	64	40	27	18	11

two-tailed α = .01 or one-tailed α = .005

	r								
Power	**.10**	**.20**	**.30**	**.40**	**.50**	**.60**	**.70**	**.80**	**.90**
.25	362	91	40	23	15	11	8	6	5
.50	662	164	72	39	24	16	12	8	6
.60	797	198	87	47	29	19	13	9	7
2/3	901	223	97	53	32	21	15	10	7
.70	958	237	103	56	34	23	15	11	7
.75	1052	260	113	62	37	25	17	11	8
.80	1163	287	125	68	41	27	18	12	8
.85	1299	320	139	76	45	30	20	13	9
.90	1481	365	158	86	51	34	22	15	9
.95	1773	436	189	102	62	40	26	17	11
.99	2390	588	254	137	82	52	34	23	13

Table values represent the total number of participants needed to obtain a significant result at the given alpha, for that effect size, and power level.

Example: to detect an r=.5 using with a two-tailed α = .01 at 80% power, I need 41 participants.

Interpolation: What about r=.35, at 80% power for a two-tailed α = .05?

$$\text{sample size} = 46 + \frac{(.40 - .35)}{(.40 - .30)} * (85\text{-}46) = 65.5 \text{ ---> } 66$$

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