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The Effect of Integrating Explicit Instruction of Literacy and Numeracy in CTE Technology Business Education on Student Achievement

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This is to certify that the doctoral study by

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has been found to be complete and satisfactory in all respects,
and that any and all revisions required by
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Walden University
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Abstract

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by

Lori Ann Mechell Canty

MPA, Troy University, 2005

BS, Winthrop University, 1992

Dissertation Submitted in Partial Fulfillment

of the Requirements for the Degree of

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August 2021

Abstract

Career and Technology Education (CTE) high school students often exhibit difficulty reaching academic proficiency in English Language Arts (ELA) and math. To address this problem, one local school district developed and implemented an integrated curriculum using explicit instruction of literacy and numeracy in CTE business education courses. Guided by Archer and Hughes's theory of explicit instruction, the purpose of this ex post facto quasi-experimental study was to determine the difference in ELA and math High School Assessment Program (HSAP) standardized test scores between 10th grade CTE business education students who participated in integrated curriculum business courses and students who had not participated prior to taking the test the first time. Archival ELA and math HSAP test scores for 216 10th grade first-time test-taker CTE business education students from the 2014-2015 school year were analyzed. Independent samples t tests for equal variances not assumed indicated that CTE business education students who participated in the integrated curriculum scored significantly higher on their HSAP tests in ELA (p = .001) and math (p =.003) than students who did not participate. Findings from this study suggest that CTE business education students benefitted from the literacy and numeracy explicit instruction in the integrated curriculum CTE business education courses. With enhanced ELA and math performance, positive social change may occur as CTE business education students are likely to experience greater academic success and improved academic outcomes across all areas of their education.

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Dedication

This dissertation is dedicated to my mom, Annie Canty, who has provided support and encouragement through this entire process.

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I would like to thank those who served on my dissertation committee. To my chair, Dr. Shrofel, who consistently provided guidance, constructive feedback, and an encouraging voice of reason during the dissertation process, I am truly thankful that she decided to chair my committee; and to Dr. Morton, for her willingness to serve on my committee at the eleventh-hour, show an interest in my topic, and for taking the time to assist me on many occasions when she probably had other things that she needed to handle.

Thank you to my church families, Greater House of Prayer and Greater Love Fellowship, for praying for me as I walked by faith to fulfill God's will for my life.

Last and most importantly, I would like to thank God for giving me wisdom, understanding, and for enabling me with endurance through this learning process.

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Chapter 1: Introduction to the Study

Career and college readiness (CCR) of the United States students continues to be a concern for the future growth of the nation as students prepare to compete globally (Aud et al., 2012; Hopwood et al., 2016, 2017; McFarland et al., 2019; Schneider & Foot, 2013). The Every Student Succeeds Act of 2015 (ESSA) was enacted to strengthen the Elementary and Secondary Act of 1965 (ESEA) and to emphasize the importance of CCR (Klein, 2016; Malin et al., 2017; Saultz et al., 2017). Because too few Career and Technical Education (CTE) students (CTE concentrators) were achieving proficient or advanced on the annual state standardized tests, Carl D. Perkins Career and Technical Education Improvement Act of 2006, P.L. 109-270, (Perkins IV) and ESEA mandated that schools integrate literacy and numeracy into CTE courses to prepare students to transition from secondary school to career or college and required the states to report their accountability measures regarding this mandate (Hackmann et al., 2019; Malin et al., 2017). With the growing concern of NCLB requirements being too severe, in September 2011, the US Department of Education provided states with waivers (ESEA Flexibility Waiver Proposal plan) that allowed states more flexibility in improving school proficiency (student achievement on annual state standardized tests).

Through the years 2011 to 2014, a school district in a southeastern state developed a CTE curriculum that included explicit instruction of literacy and numeracy in CTE courses (see Chapter 3 for the description of this curriculum). During the years 2011 through 2013, integrating rigorous and relevant literacy and numeracy into CTE curriculum was optional for CTE teachers in the district. In the school year 2014-15, the

district required that teachers implement the integrated curriculum that the district had developed. It is important to study whether this curriculum had a positive effect on CTE student scores on state standardized English language arts (ELA) and math tests because the results could inform curriculum practices of CTE programs in general, and the CTE program at the local study site in particular, where the integrated curriculum is still used. Due to the nature of the district's integrated curriculum implementation, this study focused on two groups of CTE students: 10th grade first time test-taker CTE Business Education students who were exposed to the integrated CTE curriculum and 10th grade first time test-taker CTE Business Education students who were not exposed to the integrated CTE curriculum. Such a study has the potential to contribute to positive social change by informing the development of a curriculum that will help CTE students to acquire academic skills in literacy and numeracy required to transition from school to career or college.

Chapter 1 includes an introduction to the research study and background information that summarizes the research literature related to the scope of this study and the gap in practice. In addition, this chapter describes the problem statement, the purpose of the study, the research questions and hypotheses, and the theoretical and conceptual framework for this study. This chapter also includes a brief description of the nature of the study, definitions of key terms, assumptions and limitations, and significance.

Background

Little research has been conducted regarding the integration of literacy and numeracy into the CTE curriculum at the secondary setting. Most of the researchers

studied the effect of a treatment that integrated literacy and math instruction into the instruction of CTE content. Stone et al. (2008) found that CTE students exposed to a CTE curriculum that integrated math instruction scored significantly higher on the standardized math achievement tests than did students who were not exposed to the integrated instruction. Likewise, Young et al. (2012) found that students taught a CTE curriculum that integrated mathematics achieved higher scores in mathematics than did students who did not receive the treatment. Although the results of the study were not statistically significant, students in the treatment group had higher scores than students in the control group. Pierce and Hernandez (2015) studied the integration of literacy and math into CTE introductory courses. They found that students in the treatment group achieved significantly higher literacy scores but did not achieve significantly higher math scores. NRCCTE conducted a Math-in-CTE follow-up study with the participants from the first Math-in-CTE research study (Lewis & Pearson, 2007; Stachler et al., 2013). Lewis and Pearson (2007) and Stachler et al., (2013) found students who received integrated math CTE lessons outperformed students that did not receive the integrated math CTE lessons in the Math-in-CTE study. Further research documents the benefits of the integration of mathematics into the CTE curriculum. Parr et al. (2008) tested whether the math scores of CTE students participating in the math-enhanced agricultural technology curriculum would differ significantly from students who participated in the traditional curriculum. Although the results were not significant, the researchers concluded that integration is a practical method of developing student math achievement, but the intervention needed to take place over a longer period of time (Parr et al., 2008).

Burghardt et al. (2010) found that CTE students who experienced a curriculum that integrated math instruction into a CTE course significantly increased their mathematics scores, showing that it is possible for students to learn specific mathematical content knowledge in the context in a CTE classroom environment. Castellano et al. (2011) argued that curriculum integration was beneficial to engage students and incorporate rigorous academics into the CTE curriculum. Castellano et al. found a significant increase in academic achievement as measured by standardized tests with curriculum integration and in students' potential to transition from school to career or college. Partin (2016) found that in Arizona where explicit instruction was used to integrate ELA and math content within CTE courses and teacher taught lessons aligned with the state's academic standards, CTE students performed significantly higher than the general high school population on the high stakes standardized academic test in ELA and mathematics. Concerning the quality of literacy and mathematics instruction in schools, Bozick and Benjamin (2013) suggested that more work needs to be done in CTE secondary courses to ensure the goal of integrating literacy and math is achieved and core competencies are supported.

The studies reviewed here studied the effect of a CTE curriculum that integrated literacy and numeracy into CTE curricular content. None examined the effect of integrating explicit instruction of literacy and numeracy in CTE courses. The gap in practice this study addressed was that it was unknown whether the CTE curriculum developed by a southeastern state school district that integrated explicit instruction of

literacy and numeracy had a significant effect on 10th grade first time test-taker CTE Business Education students state standardized ELA and Math test scores.

Problem Statement

Teachers and administrators in a southeastern state school district were concerned that CTE high school students were not achieving proficient or advanced in ELA and mathematics as measured by the High School Assessment Program (HSAP) test. Nationally, CTE students have underachieved in ELA and mathematics as shown by state standardized achievement scores (Hackmann et al., 2019; Long, 2016). In response to the federal mandates, the study district implemented a curriculum that included explicit instruction curriculum for literacy and numeracy to be integrated into all CTE courses during the academic year 2014-2015. The district required CTE teachers to develop lessons to increase their students' reading, thinking, math, and problem-solving skills. Academic and CTE teachers worked together to create explicit instruction in literacy and numeracy curriculum that met the standards for the ELA and mathematics subject areas. The goal of the action was to increase CTE student achievement in ELA and math as measured by the state standardized tests. However, the study district has not conducted research that would confirm that the goal was achieved. The gap in practice that this study addressed was that it was unknown whether the CTE curriculum developed by a southeastern state school district that integrated explicit instruction of literacy and numeracy had a significant effect on 10th grade first time test-taker CTE Business Education students state standardized ELA and Math test scores.

Evidence for the Problem

America has lagged behind other countries regarding students' academic achievement (DeSilver, 2017; Heitin, 2016; National Center for Education Statistics, 2016; Soulé & Warrick, 2015). Students in the U.S. continue to show deficiencies in literacy and numeracy (Niazov, 2018; OECD, 2021a; Stone et al., 2008). For the 2011, 2012, 2013, and 2014 school years, the study district was required to meet the following goals: (a) 62.5% of CTE students would achieve proficient in ELA, and (b) 61% of CTE students would achieve proficient in mathematics. In 2011, 47.4% of CTE concentrators scored proficient in HSAP ELA and 33.8% of CTE concentrators scored proficient in HSAP Math in this district. In 2012, 50.1% of CTE concentrators scored proficient in HSAP ELA and 36.7% of CTE concentrators scored proficient in HSAP Math in this district. In 2013, 53.5% of CTE concentrators scored proficient in HSAP ELA and 34.4% of CTE concentrators scored proficient in HSAP Math in this district. In 2014, 52.2% of CTE concentrators scored proficient in HSAP ELA and 28.0% of CTE concentrators scored proficient in HSAP Math in this district.

Presently, students in the United States continue to show deficiencies in literacy and numeracy (Niazov, 2018; OECD, 2021a; Stone et al., 2008; Young et al., 2017). Likewise, national reports from ACT and SAT concur there has been a decrease in standardized test scores for English, mathematics, reading, and science (ACT, 2016; CollegeBoard, 2016; OECD, 2018; OECD, 2021b; Petcu et al., 2016; USDOE, 2020). The percentage of students in the focus state who performed at or above the National Assessment of Educational Progress (NAEP) Proficient level was 32% in 2019. In 2018, 32% of CTE concentrators scored below basic in ELA HSAP and 38.5% of CTE

concentrators scored below basic in Math HSAP. It is important to examine academic integration in CTE because teachers must provide students with opportunities to acquire literacy and numeracy skills necessary for their future success in careers and college. (Anderson et al., 2012; McClure & Sircar, 2008; Mellard et al., 2012, 2016; Mukembo & Edwards, 2015; Schneider & Foot, 2013). The problem addressed in this study was lack of information about the effect of the CTE curriculum developed by a southeastern state school district that included explicit instruction of literacy and numeracy on 10th grade first time test-taker CTE Business Education students' state standardized ELA and Math test scores. Data from the 2014-2015 school year was relevant because this was the first year of full implementation of the new developed curriculum and the only year when data for a group of CTE students who did not receive the treatment was available.

Purpose of the Study

Because of low academic achievement of CTE students in ELA and mathematics as measured by state standardized test scores, legislation was enacted that mandated that school districts integrate instruction in literacy and numeracy into CTE courses (Pub. L. 109-270, 2006). The purpose of this ex post facto quasi-experimental study was to determine whether the CTE curriculum developed by a southeastern state school district that integrated explicit instruction in literacy and numeracy into CTE courses had a significant effect on 10th grade first time test-taker CTE Business Education students' academic achievement in ELA and mathematics as measured by state standardized test scores during the 2014-2015 school year. The 10th grade first time test-taker CTE Business Education students in the treatment group were taught a curriculum of explicit

instruction integrating literacy and numeracy in the CTE Business Education courses as the treatment or independent variable (IV). The 10th grade CTE Business Education students in the control group were not taught the curriculum of explicit instruction integrating literacy and numeracy in the CTE Business Education courses. HSAP standardized test scores of 10th grade first time test-taker CTE Business Education students for ELA and math are the dependent variables.

Research Questions and Hypotheses

The research questions for this ex post facto quasi-experimental study explored the effect of a CTE Business Education curriculum that integrated explicit instruction of literacy and numeracy on 10th grade first-time test-taker CTE Business Education student achievement on HSAP ELA and HSAP Math standardized tests for the 2014-2015 school year. Data from this school year is relevant because this was the first year of full implementation of the new developed curriculum and the only year when data for a group of CTE students who did not receive the treatment was available. During this school year, two CTE Business Education teachers were exempted from full implementation: one because he/she was in their retirement year and the other because he/she was a newly hired teacher who was unprepared for the integrated curriculum. In subsequent years, all CTE teachers were required to teach the integrated curriculum.

The research question and related hypothesis were:

RQ1: What is the statistical difference between the standardized HSAP ELA test scores of all 10th grade first time test-taker CTE Business Education students who were enrolled in CTE Business Education classes that integrated explicit literacy and numeracy

instruction and the standardized HSAP ELA test scores of all 10th grade first time test-taker CTE Business Education students who enrolled in CTE Business Education classes that did not integrate explicit instruction in literacy and numeracy during the 2014-2015 school year?

$H_0$1: There is no significant difference between the standardized HSAP ELA test scores of all 10th grade first time test-taker CTE Business Education students who were enrolled in CTE Business Education classes that integrated explicit literacy and numeracy instruction and the standardized HSAP ELA test scores of all 10th grade first time test-taker CTE Business Education students who were enrolled in CTE Business Education classes that did not integrate explicit literacy and numeracy instruction during the 2014-2015 school year.

H_a1: There is a significant difference between the standardized HSAP ELA test scores of all 10th grade first time test-taker CTE Business Education students who were enrolled in CTE Business Education classes that integrated explicit literacy and numeracy instruction and the standardized HSAP ELA test scores of all 10th grade first time test-taker CTE Business Education students who were enrolled in CTE Business Education classes that did not integrate explicit literacy and numeracy instruction during the 2014-2015 school year.

RQ2: What is the statistical difference between the standardized HSAP Math test scores of all 10th grade first time test-taker CTE Business Education students who were enrolled in CTE Business Education classes that integrated explicit literacy and numeracy instruction and the standardized HSAP Math test scores of all 10th grade first time test-

taker CTE Business Education students who were enrolled in CTE Business Education classes that did not integrate explicit literacy and numeracy instruction during the 2014-2015 school year?

$H_0$2: There is no significant difference between the standardized HSAP Math test scores of all 10th grade first time test-taker CTE Business Education students who were enrolled in CTE Business Education classes that integrated explicit literacy and numeracy instruction and the standardized HSAP ELA test scores of all 10th grade first time test-taker CTE Business Education students who were enrolled in CTE Business Education classes that did not integrate explicit literacy and numeracy instruction during the 2014-2015 school year.

H_a2: There is a significant difference between the standardized HSAP Math test scores of all 10th grade first time test-taker CTE Business Education students who were enrolled in CTE Business Education classes that integrated explicit literacy and numeracy instruction and the standardized HSAP ELA test scores of all 10th grade first time test-taker CTE Business Education students who were enrolled in CTE Business Education classes that did not integrate explicit literacy and numeracy instruction during the 2014-2015 school year.

Theoretical Framework for the Study

The theoretical framework for this study is the theory of explicit instruction as developed by Archer and Hughes (2011). According to Archer and Hughes, “explicit instruction is a clear and precise approach to teaching that includes both instructional design and delivery procedures” (2011, p. 1). Explicit instruction uses scaffolding to help

students comprehend and transfer knowledge obtained as students become independent learners (Boyd & Higgins, 2018). Explicit instruction builds on individual and collective knowledge with a deeper understanding (Archer & Hughes, 2011). Archer and Hughes's theory is based on fundamental foundation that all children can learn successfully if taught competently. Other educators apply elements of explicit instruction as an evidence-based teaching practice (Brophy, l986; Hall & Vue, 2014; Rosenshine, 1995; Rosenshine et al., 1996; Rosenshine & Stevens, 1986). Explicit instruction is one key component of effective teaching and will be explained in more detail in Chapter 2.

Nature of the Study

The research design of this study was ex post facto quasi-experimental research design (Creswell, 2012). As Lodico et al. (2010) explained, "Ex post facto examines the effect of an *independent* variable (the past experience) on a *dependent* variable while controlling extraneous variables" (p. 13, emphasis added). The ex post facto quasi-experimental design was the best choice given my research questions and that I used archived data of the student ELA and math scores for intact groups. The ex post facto quasi-experimental approach allowed me to examine, in retrospect, the effect of the independent variable (integration of explicit instruction of literacy and numeracy) on the dependent variables (HSAP standardized test scores for ELA and math of 10th-grade first time test-taker CTE Business Education students) using previously collected archival data. The data consisted of archived 2014-2015 state standardized test scores for 10th grade first time test-taker CTE Business Education students who experienced the treatment and for those who did not. The data for the group of 10th-grade first time test-

taker CTE Business Education students who did not receive the treatment was available only because two CTE Business Education teachers were exempted from full implementation: one because he/she was in their retirement year and the other because he/she was a newly hired teacher who was unprepared for the integrated curriculum. In subsequent years, all CTE teachers have been required to teach the integrated curriculum. The deidentified data was provided by the district test coordinator.

The purpose of this ex post facto quasi-experimental study was to determine whether the CTE curriculum developed by a southeastern state school district that integrated explicit instruction in literacy and numeracy into CTE courses had a significant effect on 10th grade first time test-taker CTE Business Education students' academic achievement in ELA and mathematics as measured by state standardized test scores during the 2014-2015 school year. To achieve this goal, I collected archived data of the school district's 2014-2015 HSAP test scores of 10th grade first time test-taker CTE Business Education students who received the treatment and of those who did not. I analyzed the data using an independent samples *t* test to determine whether 10th grade first time test-taker CTE students who were exposed to the integrated curriculum in 2014-2015 performed significantly better on the HSAP ELA and HSAP Math standardized test than 10th grade first time test-taker CTE students in 2014-2015 who were not exposed to the integrated curriculum.

Definitions

The study used the following special terms:

Concentrator. A concentrator is a secondary student who is assigned to the Classification of Instructional Program (CIP) and has earned or will earn 3 units of Carnegie credits in a state-recognized Career and Technology Education (CATE) program.

First-time test takers. Tenth grade high school students who took the HSAP tests for the first time during their second year of high school.

High school assessment program (HSAP) standardized test. The HSAP is comprised of an English language arts test and a mathematics test. The tests are proctored to State high school students. The HSAP meets federal and state requirements as well as the requirements of the Education Accountability Act (EAA) of 1998 (S.C. Code Ann. §§ 59-18-1300 and 59-139-10 *et seq.* (Supp. 2004),

Integration. Integration consists of the following: (a) incorporating more academic content into CTE courses; (b) making academic courses more relevant to real-world occupations; (c) aligning standards of both CTE and academic courses; (d) combining CTE and academic teachers to increase academic competencies in CTE classes; (Grubb et al., 1991). In this study, integration is defined as the daily 15 minutes mini lessons of literacy and numeracy integrated into the CTE curriculum to increase academic achievement.

Assumptions

The primary assumption was that the 10th grade first time test-taker CTE Business Education students would take the HSAP ELA and HSAP Math tests seriously and try to achieve well on both standardized tests. Another assumption was that only the

CTE students enrolled in the integrated classrooms received integrated explicit instruction in ELA and mathematics. In addition, it was assumed that the CTE Business Education teacher who implemented the integrated curriculum was doing so as required by the program for the semester, and all CTE Business Education teachers were equally effective teachers in their subject area.

Scope and Delimitations

The scope and delimitations of this ex post facto quasi-experimental study was one high school in a rural Southeast school district in 2014-2015 year. While this district may be somewhat representative of other rural districts statewide and nationally, certain factors may be specific to this district in terms of its image, recruitment practices, geography, and demographics that would not be representative of other rural or suburban districts. Only 10th grade first time test-taker CTE Business Education students enrolled during 2014-2015 were included in the study. I acquired archival CTE data, from the district representative, focused on the HSAP scores of 10th grade first time test-taker CTE Business Education students whose teachers taught the integrated explicit instruction curriculum (i.e., the IV condition), and with 10th grade first time test-taker CTE Business Education students whose teachers did not teach the integrated curriculum during the Fall semester of the 2014-2015 school year to determine whether the treatment significantly effected HSAP ELA and Math scores of 10th grade first time test-taker CTE Business Education students who received the treatment as compared to 10th grade first time test-taker CTE Business Education students who did not receive the treatment.

Limitations

One limitation is that the sample includes only 10th grade first time test-taker CTE Business Education students from one high school and does not represent all CTE high school students. The study did not consider the socioeconomic status of students, student attendance, parental involvement, student behavior, and teacher qualifications that research shows are factors that could explain the academic achievement of students on HSAP. In addition, the independent variable was not manipulated by the researcher because it occurred before the study began. Another limiting factor in this study was the examination of a single southeastern state school district. The findings of this study were also limited by the duration of the treatment, which was five months. Some students may need more time to practice and fully develop concepts. Measures (see Chapter 4 for the description of the treatment fidelity) were utilized to ensure that the integrated treatment occurred and teachers documented any variations in the treatment in their lesson plans (e.g., school canceled; student and teacher attendance; school assembly) that may have influenced student performance on the HSAP assessment. Lastly, there was a lack of research literature on CTE content area in this southeastern state and across the nation. These potential limitations were acknowledged when interpreting the results and their generalizability.

Significance

The ex post facto quasi-experimental study contributes to the body of literature on explicit instruction and integration of literacy and numeracy in CTE content area. It is projected that this research will enhance teachers' knowledge of the effect of a CTE

curriculum that integrated explicit instruction of literacy and numeracy into CTE curricular content.

The findings from the study have the potential to contribute to practice. This study is significant because it advances practice in the field of curriculum integration by showing the effectiveness of explicit instruction of literacy and numeracy integration in CTE courses. Furthermore, this study has potential to contribute to positive social change by contributing knowledge in the field about practice that lead to CTE students obtaining ELA and math skills that allow them to transition from school to career or college. In the United States, it is imperative that all students possess career and college readiness skills. With the passing of ESSA (Klein, 2016; Saultz et al., 2017) and the enactment of the Strengthening Career and Technical Education Act for the 21st Century Act (Perkins V, Public Law 115-224) (Imperatore & Hyslop, 2017; Park et al., 2017), the amount of rigor embedded in the standards is also increasing, CTE teachers are looking for strategies to integrate literacy and numeracy into the curriculum to increase student achievement (Park et al. , 2010; Stone et al., 2008; Tews, 2011). Before determining if an explicit instruction curriculum integrating ELA and math into CTE courses could impact students' academic achievement, evidence was needed. This study provided data to determine whether the CTE curriculum developed by a southeastern state school district that included explicit instruction of literacy and numeracy had a significant effect on 10th grade first time test-taker CTE Business Education students state standardized ELA and Math test scores. The findings for this study may contribute to advancing knowledge about instructional strategies and resources that support CTE student learning and academic achievement.

Summary

Chapter 1 provided a description of the problem and the gap in practice that it was unknown whether a CTE Business Education curriculum that integrated explicit instruction of literacy and numeracy had a significant effect on 10th grade first time test-taker CTE Business Education student state standardized test scores. The purpose of this ex post facto quasi-experimental study was to determine whether the CTE curriculum developed by a southeastern state school district that integrated explicit instruction in literacy and numeracy into CTE courses had a significant effect on 10th grade first time test-taker CTE Business Education students' academic achievement in ELA and mathematics as measured by state standardized test scores during the 2014-2015 school year. The theoretical framework of explicit instruction was described. The research questions were stated along with an overview of the proposed methodology.

Chapter 2 will include a review of the related literature and the description of the literature search strategy. In addition, the theoretical foundation regarding explicit instruction is discussed in more detail, and current research is analyzed and synthesized in relation to integrating literature and numeracy in the CTE curriculum.

Chapter 2: Literature Review

The purpose of this ex post facto quasi-experimental study was to determine whether the CTE curriculum developed by a southeastern state school district that integrated explicit instruction in literacy and numeracy into CTE courses had a significant effect on 10th grade first time test-taker CTE Business Education students' academic achievement in ELA and mathematics as measured by state standardized test scores during the 2014-2015 school year. The problem addressed in this study is lack of information about the effect of the CTE curriculum developed by a southeastern state school district that included explicit instruction of literacy and numeracy on 10th grade first time test-taker CTE Business Education students' state standardized ELA and Math test scores. This chapter will review the literature pertaining to the central concepts related to the problem. This chapter includes a description of the literature search strategy used to conduct this review, and a discussion of the theoretical framework. Research studies were analyzed and synthesized in relation to the following topics: (a) the effectiveness of explicit instruction, (b) integration of literacy and math in the CTE curriculum, and (c) the effect of curriculum integration on student achievement. This chapter concludes with a summary and conclusions regarding this review of the research.

Literature Search Strategy

The reviewed literature was derived from a variety of current primary and secondary sources including, but not limited to books, peer-reviewed journals, and online journals. Walden University's online library and Association for Career and Technical Education website was utilized. The following databases were used to identify relevant

literature: EBSCOHost, ERIC, EdLit, Google Scholar, ProQuest Dissertations, ProQuest Central, Educational Resources Information Center, Taylor & Francis Online, Thoreau, Research Gate, Sage Premier, Science Direct, United States Department of Education, and the Walden University Library dissertation database of related topics. Reference lists from articles and textbook chapters were also used to locate relevant authors and articles that spanned the last 5 years from 2016-2021. I conducted a thorough search to use current articles but few were found. So, it was necessary to use some older sources because of their significance to the research study.

This review of existing literature focused on a curriculum of explicit instruction used to integrate literacy and numeracy in CTE courses and its effect on the academic achievement of CTE students as measured by state standardized test scores. Keywords used in the search were *theoretical framework on academic achievement, academic collaboration, academic and CTE, blended curriculum, blended learning and CTE, curriculum integration, curriculum integration in CTE, curriculum integration in secondary setting, career and technology education (CTE), direct instruction, explicit instruction, explicit instruction in CTE, explicit instruction in secondary settings, high school math achievement, high school literacy achievement, improving high school scores, integration, integrating literacy and numeracy in secondary setting, integrating ELA and mathematics in CTE, literacy integration, Literacy-In-CTE, mathematical integration, Math-In-CTE, numeracy, the benefits of curriculum integration, professional development for teachers in academic content integration in CTE, reading comprehension, standardized testing, and vocational education*.

Approximately 150 articles, books, or other resources were reviewed for this study. Resources were selected on the basis of relevance and timeliness to the study. In order to reach full saturation, I examined the literature; I conducted keyword searches of all these terms individually and in combination, until I found no new references. Several times, I conducted citation searches in Google Scholar to ensure that all references and their included citations were exhausted. The last citation search that I conducted was in May 2021. From this, I selected the most relevant studies and read all pertinent research materials relating to explicit instruction and integration of literacy and mathematics into CTE curriculum. Because there was little current literature, I reviewed older studies such as Buck (2015), Doabler and Fien (2013), Doabler et al. (2014), Luke (2014), Pearson et al., (2010), Pedrotty-Bryant et al. (2015), Stone (2013), and Stone et al. (2008) to illustrate the effectiveness of explicit instruction, integration of literacy and math in the CTE curriculum, and the effect of integration on student achievement.

Theoretical Foundation

The study is grounded by the theoretical foundation of Explicit Instruction. Archer and Hughes (2011) described 16 elements of explicit instruction that can be grouped into five teaching functions. The five functions are hook, modeling, guided practice, independent practice, and closure.

Hook (Introduction)

At the beginning of a lesson, teachers need to stimulate students' prior knowledge and experiences to help students comprehend the relevance of the lesson (Agrawal & Morin, 2016; Echevarria et al., 2016; National Center on Intensive Intervention, 2016;

Vogt et al., 2016). Teacher explains the lesson standards, new vocabulary, objectives, and methods for assessment. Teacher reviews prerequisite skills and shares how the new acquired skills can be used in real life scenarios outside the classroom. The students are actively engaged, listening, and responding to questions. Finally, the teacher assesses whether students are able to answer the essential questions and explain the learning objectives in their own words.

Modeling (I Do)

Teacher thinks aloud while demonstrating concise, consistent skills and knowledge of what students should learn and know after completing the lesson. Students watch, listen, and perform notetaking during modeling, as well as communicate ideas and information. Researchers (Bryant et al., 2016; Doabler, Clarke et al., 2021; Doabler & Fien, 2013) recommend teacher modeling as an effective explicit instruction strategy in mathematics. Effective teacher models demonstrate the math content, lead guided practice with timely feedback, provide an opportunity for students to apply the new math content, and eventually actively engage students in independent practice (Archer & Hughes, 2011; Hughes et al., 2017; Witzel & Little, 2016).

Guided Practice (We Do)

Teacher directs a guided practice and prompts students to practice the skills. Doabler and Fien (2013) suggested using purposeful verbal prompts during guided practice. Also, teacher continues to check for students' understanding of concepts, reinforce skills taught during previous stages, monitor, and assess students' performance

and provide immediate positive feedback (Hammond & Moore, 2018; Plavnick et al., 2015). Students work on the assignment with some assistance from the teacher or peers.

Independent Practice (You Do)

Students practice concepts and skills independently. Teacher walks around the room monitoring students and offering support and words of encouragement as students practice the concept and skills. Teacher is fully responsible for student learning but gradually relinquishes this responsibility to students as the students become successful (Marchand-Martella & Martella et al., 2013; Ritchey, 2011). Students continue practicing the skills applying what they have learned until students master the concept.

Closure (Review)

Teacher reviews the concepts and objectives. Teacher provides a closure or final assessment to reaffirm students' mastery of objectives and standards. Students may do an exit slip to reflect on what they have learned. Explicit instruction can give struggling learners an advantage when learning to read or use new mathematics computations (Coyne et al., 2009; Gottfried et al., 2016; Marita & Hord, 2017). The National Mathematics Advisory Panel (2008) stated, "Explicit systematic instruction typically entails teachers explaining and demonstrating specific strategies and allowing students many opportunities to ask and answer questions and to think about the decisions they make while solving problems" (p. 48). In this study, explicit instruction was incorporated as teachers led guided practice to help students create connections and relationships between academic skills and occupational content.

Explicit instruction has a history of helping students develop reading comprehension strategies, as well as providing remediation directly to students when needed (Daffern et al., 2020; Hughes et al., 2017; Marchand-Martella et al., 2016). Teachers incorporated explicit instruction strategies that guided students in developing problem-solving and computational thinking techniques that the students could use in their mathematical content area on the standardized test. Likewise, teachers utilized explicit instruction with explanations and demonstrations when needed to teach specific reading skills and strategies (Archer & Hughes, 2011). Using explicit instruction effectively, teachers monitored student performance, teachers directed instruction, teachers provided immediate feedback, teachers adapted lessons to meet the unique needs of students, and teachers helped the students acquire essential skills.

Grounded in the work of Archer and Hughes (2011), the theory of explicit instruction embraces techniques that move students from having little to no knowledge about a concept to mastery where high-level skills and techniques are performed by students (Martella et al., 2012; Rosenshine, 2008). Explicit instruction was used to scaffold and support the development of integrating literacy and numeracy into the CTE curriculum at the study site. Teachers used explicit instruction for purposeful lesson planning around the state standards; teachers delivered the 15 minutes mini lessons with intent, and assessed how well the students learned the taught concepts. Explicit instruction is considered “helpful to all students learning new skills and content and is essential for struggling or disadvantaged learners” (Archer & Hughes, 2011, p. 17).

Explicit instruction helps students learn the content, think critically, and understand the objectives of the standards (Hempenstall & Buckingham, 2016; Hughes et al., 2017).

Meta-analyses of direct and explicit instruction for math demonstrate that this pedagogical approach is highly efficacious for instructing students struggling in mathematics (Dennis et al., 2016; Hwang & Riccomini, 2016) and for reading (Al-Darayseh, 2014; Gersten & Santoro, 2007; Hughes et al., 2017; Kavale, 2007; Smith et al., 2018; White, 1988). Kavale (2007) also pointed to meta-analytic evidence showing that direct, explicit pedagogical methods are at least 6.5 times (*ES*=.93) more effective than modality-matched approaches (*ES*=.14) popular in education that are used to match learning styles to a particular instructional strategy. This finding roughly translates to students being taught under the direct, explicit method gaining "11 months' credit on an achievement measure compared to about one month for modality-matched instruction" (Kavale, 2007, p. 215). Researchers (Dewey, 1956; Doabler et al., 2014, 2015; Wang et al., 2016) investigated the effects of explicit instruction integration on students' learning outcomes in the elementary setting and found that an explicit core kindergarten mathematics curriculum had the capability to benefit all students.

In the context of this study, the explicit instruction combines all five teaching functions to help students master ELA and math lesson standards, new vocabulary, and objectives within the CTE curriculum (Pierce & Hernandez, 2015). The school district used this explicit instruction framework to develop a treatment. Explicit instruction provided teachers with tools and strategies that helped students formulate concepts and perceptions about the ELA and mathematical standards (Archer & Hughes, 2011; Cohen,

2018; Stockard et al., 2018). I selected explicit instruction theory because it allowed the use of scaffolding to ensure success as students achieve confident, independent learning. The theoretical framework of explicit instruction related to the study because it allowed for individualized direct instruction, careful monitoring of learning, and immediate regular feedback (Hammond & Moore, 2018). The research questions related to the explicit instruction theory because it assessed the effects of the theory as a treatment. In this study, the effectiveness of the explicit literacy and numeracy instruction was measured by the HSAP standardized assessment scores.

Literature Review Related to Key Variables

The Effectiveness of Explicit Instruction

In the field of education, explicit instruction refers to teacher-centered instruction that is focused on clear behavioral and thinking-related goals and results (Luke, 2014). Goals and results, in turn, are made explicit or open and honest to learners. Students are told what they will be learning and how, and what they must do to show that they have succeeded in learning the content, which is linked to the standards and objectives (Freeman, 2017; Hempenstall & Buckingham, 2016; Hughes et al., 2017). The aim of explicit instruction is a strong focus on course content and clearness of expected requirements for performance, which will help determine if a curriculum of explicit instruction integrating literacy and math in the CTE curriculum will make a significant difference in academic achievement on a standardized test. Explicit instruction is associated with but not limited to highly structured instruction in basic skills in early literacy and numeracy education (Luke, 2014). Explicit instruction is a key teaching

method used commonly in schools today that has shown or proved effective in the teaching and learning of clearly stated skills and knowledge.

In 2008, IES published a practice guide called Improving Adolescent Literacy: Effective Classroom and Intervention Practices (Kamil et al., 2008). The guide provided recommendations for secondary teachers to include explicit instruction to improve literacy levels. The guide provided five recommendations about improving adolescent literacy and offered strategies for implementation of each recommendation. The first three recommendations that explicitly addressed content literacy instruction (Kamil et al., 2008) are listed below:

Provide Explicit Vocabulary Instruction

Teachers should provide learners with a clear meaning of new terminology. By providing explicit instruction, teachers help students improve their comprehension skills of new terms or text (Kamil et al., 2008). To achieve the goal, teachers must provide time at the beginning of the lesson to teach new terminology or technical terms, and give students opportunities to use new terminology or technical terms in a variety of contexts throughout classroom activities such as discussion, journaling, and word walls (Lewis & Strong, 2020; Neuman et al., 2014; Sedita, 2011).

Provide Direct and Explicit Comprehension Strategy Instruction

Reading comprehension is a great concern in the secondary setting because adolescents struggle with understanding content in their textbooks (Biancarosa & Snow, 2006; Kamil, 2003; Lewis & Strong, 2020; Ness, 2016). Explicit instruction can be used to provide guided practice on comprehending text, and assess students understanding of

the text (Kamil et al., 2008; Lewis & Strong, 2020; Scammacca et al., 2015; Sedita, 2011).

Provide Opportunities for Extended Discussion of Text Meaning and Interpretation

Kamil et al. (2008) conducted a quasi-experimental study using collaborative reasoning. The study lasted for five weeks. Students engaged in open discussions about the text they had read and participated in open debates, using evidence from the text they read to support their point of view. Kamil et al. argued providing a discussion protocol guide in advance for small group discussions is beneficial and additional questions can be asked to broaden the discussion. Kamil et al. concluded that there was a need to improve reading instruction and adolescents' comprehension skills so that adolescents can succeed in content reading instruction.

Gersten, Chard et al. (2009) reviewed 11 studies where explicit instruction was used to teach mathematics to learning disabled students and reported a rather large Hedges' effect (g = 1.22), suggesting more than a one standard deviation shift favoring explicit instruction over student verbalization of mathematical reasoning. Some researchers (Dennis et al., 2016; Gersten, Chard et al., 2009; Hughes et al., 2017; National Mathematics Advisory Panel, 2008; Smith et al., 2018) agreed with Gersten et al., that explicit instruction used in literacy and mathematics instruction benefits all students with individualized support and instruction.

Likewise, Clark et al. (2012) established that direct explicit instruction is more beneficial than partial guidance for beginners. Teachers are more effective when teaching additional material and skills to students when they offer clear instruction followed by

practice and feedback, not when they enable students to explore certain facets of why they have to learn. Teachers who provide explicit instructions thoroughly explain the concepts and skills that students need for understanding and to become independent learners (Clark et al., 2012).

Explicit instruction has been used to teach essential reading skills (Archer & Hughes, 2011; Carnine et al., 2010) and mathematical skills (Chodura et al., 2015; Dennis et al., 2016; Fuchs et al., 2016; Gersten, Beckmann et al., 2009; Gersten, Chard et al., 2009; Satsangi et al., 2018; Satsangi et al.2018; Smith et al., 2018) in the classroom. Researchers established a struggling student needs direct, explicit instruction (Al-Darayseh, 2014; Clark et al., 2012; Hughes et al., 2017; Viel-Ruma et al., 2010) and explicit instruction provides a design to advance quality teacher and student interaction around essential mathematics standards (Doabler, Cary et al., 2012; Doabler, Clarke et al., 2021; Doabler & Fien, 2013; Doabler et. al., 2012; Long et al., 2021; Reutzel et al., 2014; Spooner et al., 2018). Explicit instruction combines the use of several scientifically validated learning strategies/methods (e.g., verbal, written, and/or visual instructions) to effectively teach students and generate positive effects on student learning (Coyne et al., 2011; Goldenberg, 2013). Scaffolding is often used to support students based on intelligence, previous knowledge, and academic ability. Explicit instruction strongly uses scaffolding techniques to guide students through the learning process while checking for student understanding and providing feedback every step of the way (Archer & Hughes, 2011; Benner et al., 2013; Doabler, Fien et al., 2012; Rowe & Zegwaard, 2017). Explicit instruction has been effective in helping struggling students acquire the skills necessary

for proficient reading and critical thinking (Comber, 2013). Several researchers, (Clark et al., 2012; Hollingsworth & Ybarra, 2018; Kirschner et al., 2006; Marchand-Martella et al., 2016; Pedrotty-Bryant et al., 2015; Rupley et al., 2009; Woodward, 2004, 2011), regarded explicit instruction as one of the best systematic, efficacious pedagogical techniques for educating students at-risk of academic failure, and helping students gain comprehension and critical thinking skills necessary for future success.

Integration of Literacy and Math in the CTE Curriculum

Over time, educators and policymakers have realized the need to shift to an approach that integrates ELA and mathematics into CTE curriculum (Hoachlander & Steinhauser, 2015; Morningstar et al., 2018; Rose, 2016). Educator and policymakers realized that CTE programs which taught only occupational skills and did not provide skills for entering college or careers, were outdated (Aldeman, 2010; Brand et al., 2013; Castellano et al., 2017; Dougherty & Lombardi, 2016; Drake & Reid, 2018). Because national and state accountability legislation requires teachers to equip students to achieve a score rated proficient or advance on standardized academic assessments and become career and college ready, it is important to have an understanding of integrating ELA and mathematical instruction throughout all educational curriculums (Asunda et al., 2015; Bottoms, 2007, 2008; Brand et al., 2013; Cravens, 2020; Giani, 2019; Meeder & Suddreth, 2012; National Business Education Association, 2013; Pearson, 2017; Wendt, 2013). Perkins IV (Pub. L. 109-270, 2006) and ESSA, federal legislations, mandated that literacy and mathematical skills were integrated into CTE courses and that student academic achievement in ELA and mathematics must improve (Civic Impulse, 2016;

Klein, 2016; Malin et al., 2017; Saultz et al., 2017). States must meet the annual yearly progress of student achievement performance requirements in CTE as outlined in the federal mandates. The state would develop and administer annual, high-quality statewide assessments of ELA and math that measure academic progress which they reported annually. Teachers must teach students ways to link basic skills to authentic content areas so that students can generalize the information and skills outside the classroom and integration provides the means (Hasselquist & Kitchel, 2019; Kuczera, 2011; Perin, 2011).

There was research regarding curriculum integration in STEAM and STEM. In the STEAM, art has been used to teach math concepts (DeJesus-Rueff, 2016; Dell'Erba & Education Commission of the States, 2019), improve student capabilities in critical thinking, deductive reasoning, and problem-solving (Ernest, 2016; Herro & Quigley, 2016; Lahana, 2016), as well as improve academic performance (Borsay & Foss, 2016; Hunter-Doniger & Sydow, 2016; Yoon & Strobel, 2017). Prior to STEAM was STEM that increased student advancement in mathematics and science course in secondary school settings and the opportunities to transition to college (Gottfried & Bozick, 2016; Sublett & Plasman, 2017). Since this study began, this state has created a STEAM Implementation Continuum to provide guidance and consistency of standards and assessment used in STEAM education; however, this study was developed to investigate the effectiveness of the CTE curriculum developed by a southeastern state school district that integrated explicit instruction in literacy and numeracy into CTE courses on 10th

grade first time test-taker CTE Business Education students' academic achievement in ELA and mathematics as measured by state standardized test scores.

Some factors that may influence implementation of integrated curriculum are the limited preparation time of teachers, the skills to develop lesson plans to teach integrated curriculum successfully, lack of collaboration, and compatible working hours with their peers (Fu & Sibert, 2017; Mukembo & Edwards, 2015). In 2010, NRCCTE maintained that literacy and math integrations into CTE courses are important building blocks for increasing student achievement. Today's high school students need to acquire literacy and math skills necessary to become college and career ready (Dunkerly-Bean & Bean, 2016; Giani, 2019; Heyward, 2019; International Center for Leadership in Education, 2012; Neild et al., 2015; O'Sullivan & Dallas, 2017; Saunders et al., 2017). Once students acquire literacy skills, students need to retain the literacy skills to achieve academic achievement and transition to post-secondary settings. Adept use of literacy skills is necessary to achieve in college and in a career setting (Dunkerly-Bean & Bean, 2016; Ness, 2016).

CTE learning adjusted over the past two decades, as did student interests, workplace demands, and technology integration (Kreamer et al., 2015; Larson, 2014). The traditional CTE programs no longer serve the needs of students or society because of disparity between the jobs that will be created over the next decade and the education and training of students and future adult workers (Carnevale et al., 2010; Lake & Center on Reinventing Public Education, 2018; Visher & Stern, 2015). To compete in the future, students must be able to think objectively and possess technical knowledge and skills

(DiBenedetto & Myers, 2016; Hart Research Associates, 2015). Employers require employees who can problem solve, think analytically, manipulate data and communicate well (Dougherty, 2018; Hemelt et al., 2019; McClure & Sircar, 2008).

Reading and literacy skills empower and motivate youth to accumulate data and construct knowledge from different sources and then critically think of solutions to real-life issues as needed (Beane, 1997; Guthrie & Klauda, 2014; Ingram et al., 2016; Kopzhassarova et al., 2016; Rennie et al., 2013). By integrating literacy in the CTE curriculum, teachers empower and prepare students with knowledge and skills to succeed in school, vocations, and everyday life (Kosloski, & Ritz, 2016; Polkinghorne & Webb, 2014). Additionally, literacy is the portal for learning and succeeding academically in other subjects (Park et al., 2012; Schwabe et al., 2015). It is important to use the appropriate intervention to improve literacy skills (Mellard et al., 2016).

Literacy.

It is a mistaken belief that only English teachers should provide literacy instruction. One author noted that stagnant literacy rates for older students were associated with a higher level of investment in early teaching and learning for literacy at the expense of addressing the literacy needs of older learners (Sedita, 2011). Sedita (2011) cited the 2010 Carnegie Council on Advancing Adolescent Literacy report that found that early education in grades K–3 “does not inoculate students against struggle or failure later” (p. 1). Sedita (2011) terms youth literacy as starting in grade 4. Explicit instruction is needed to help older students acquire the phonics, fluency and understanding skills required for high school and beyond success (Sedita, 2011).

Teachers distress over the inability of students to comprehend what they read. Comprehension is the purpose that we read (Kamil et al., 2008; Scharlach, 2008; Seidenberg, 2018). Graham and Perin (2007) noted that "reading comprehension and writing skills are predictors of academic success and a basic requirement for participation in civic life and the global economy" (p. 3). Polkinghorne and Hagler's (2012) study of integrated reading literacy interventions in business course concluded that learners in high school settings are more likely to struggle with comprehension. There is not much literacy research on CTE students at the secondary levels; secondary teachers may struggle to find research on instructional strategies of integrating literacy into the CTE curriculum (Biancarosa & Snow, 2006; Calkins & Ehrenworth, 2016; Kamil, 2003; Wendt, 2013).

Rigorous literacy skills are becoming requisites in CTE courses and the workforce. Developing literacy skills presents a problem for educators and students globally (Genlott & Grönlund, 2013; Graham et al., 2017; Kavanagh & Rainey, 2017). Although literacy skills are essential for academic achievement, NAEP (2011) reported one-third of high school students are not proficient in reading (Fang & Schleppegrell, 2010).

The NRCCTE conducted a pilot study titled *Authentic Literacy Applications in CTE* to evaluate the impact of disciplinary literacy strategies on the students enrolled in CTE courses learning to read and comprehend (Park et al., 2010). Teachers supported students' learning by providing assistance as they learned new literacy strategies (Park et al., 2010). Using disciplinary literacy strategies within the CTE framework was more

effective, and CTE teachers could engage students more when students understood the importance of mastering reading to obtain their future career (Park et al., 2010). Guthrie et al.'s (2013) study agrees that students must understand the importance and relevance of developing literacy skills to use in their daily life.

Research suggests that incorporating content that interests students is one way to help students gain literacy skills (Hyslop, 2010a, 2010b; Master et al., 2017). To improve literacy skills and engage unenthusiastic readers, teachers must provide motivational-engagement to help students realize the importance of reading and writing and develop comprehension skills of informational texts (Guthrie et al., 2013). In addition, students need a range of learning approaches (e.g., graphic organizers, project-based learning, multimedia, and experiential learning) for effective reading comprehension and improved test scores (Alhabahba et al., 2016; Armstrong et al., 2018; Somjai & Soontornwipast, 2020).

Students need opportunities to develop literacy skills, critically think, collaborate and produce in a CTE classroom. CTE students' literacy skills increased when students were allowed more time for activities (Archer & Hughes, 2011; Vaites, 2003). Practice sessions and corrective feedbacks are properties of explicit instruction and have proven to be effective in students' achievement in writing (Olagbaju, 2019). Hence, literacy is a prerequisite to learning and the cornerstone of instruction (Iwai, 2016; National Business Education Association, 2013).

Reading.

Reading comprehension is an essential objective of any reading activity (Hock et al., 2009; Hock & Mellard, 2005). In the 21st Century, reading proficiency is imperative to all citizens (Aslan, 2016; Coyne et al., 2011). CTE teachers need the competencies to provide strategic instruction on reading so students can improve their reading ability. According to Goldman (2012), "Students need to read to learn. Successfully reading to learn requires the ability to analyze, synthesize, and evaluate information from multiple sources" (p. 89). Several researchers (Gatcho & Hajan, 2019; Meniado, 2016; Suhono, 2019) agreed that comprehension and vocabulary skills could be improved using explicit teaching of metacognitive strategies. Wexler et al. (2010) expressed that students require more intensive interventions that included direct and explicit instruction in word- and text-level skills as well as engaged reading practice with effective feedback. Explicit instruction comprehension strategies have benefited students with reading problems and disabilities (Wexler et al., 2010). Likewise, other researchers found high school students continued to struggle with reading and learning content and the researchers recommended literacy integration to help struggling readers improve their reading skills and content knowledge (Hirade, 2016; Wexler et al., 2017). These studies confirmed integrating literacy is beneficial in helping students succeed academically.

Mathematics Instruction/Integration

When math is integrated within the CTE curriculum, students realize the relevancy of math and are inspired to master the concepts (Stone et al., 2008). CTE courses emphasize students learning reading and math skills that are relevant and needed

for success in their future area of occupation which Akinwumiju (2010) advocated in his study. Developing reading, writing, and mathematical comprehension skills prepares students for academic success (Akinwumiju, 2010; Calkins & Ehrenworth, 2016). Likewise, Showalter (2017) maintains that teaching integrated math in CTE curriculum is effective in helping students succeed academically.

The rate in which teachers utilize explicit instruction for individual student practice opportunities can make core mathematics instruction more effective for all the learners (Doabler et al., 2018). Several researchers (Jitendra et al., 2018; Kirschner & De Bruyckere, 2017; Stevens et al., 2018) agreed students with mathematics difficulties have demonstrated improved mathematics performance when educators implement interventions targeted at improving mathematic. Stevens et al. (2018) review of 25 studies of mathematical interventions for students with mathematical difficulties support the use of explicit instruction in problem-solving, fractions, and general mathematics skills. Teachers must optimize instructional time if students with learning disabilities and mathematics difficulties are to become proficient in mathematics (Jitendra et al., 2018).

Teachers are required to address standards in the classroom that are explicit and relevant to the math concepts. Stone et al. (2008) stated, “CTE courses have the best potential for demonstrating to students that rigorous math is highly relevant” (p. 791). The CTE curriculum, which incorporates mathematical concepts into the curriculum, offers opportunities for teaching and learning that integrate real-world mathematical abilities to prepare students for college and careers (Park et al., 2017; Spooner et al., 2018).

In 2008, NRCCTE conducted an experimental study of mathematical curriculum integration among CTE students in various CTE courses. In this national Math-in-CTE study (Stone et al., 2008), CTE teachers worked together with mathematics teachers to create lesson plans that integrated math concepts in the CTE content. Then the CTE teachers taught the new integrated lessons throughout the school year.

After one year of experiencing the integrated math CTE lessons, students that received the integrated math CTE lessons showed significant improvement and outperformed students that did not receive the integrated math CTE lessons in the Math-in-CTE study (Pearson et al., 2010; Stachler et al., 2013; Stone, 2013; Stone et al., 2008; Williams, 2013). In addition, the students could utilize the math skills acquired after the semester concluded (Stone, 2013; Stone et al., 2008; Williams, 2013).

In the Spring of 2006, NRCCTE conducted a Math-in-CTE follow-up study with the participants from the first Math-in-CTE research study (Lewis & Pearson, 2007; Stachler et al., 2013). The mixed-methods data revealed that the participating teachers believed that extensive professional development that delivered explicit instruction in the math concepts was necessary to understand and properly use the seven-element pedagogical model. The CTE and mathematics teachers created learning communities and used the seven-element pedagogical model and the math-enhanced lessons developed during the study (Lewis & Pearson, 2007; Stachler et al., 2013). Lewis & Pearson and Stachler et al. concluded students that received integrated math CTE lessons outperformed students that did not receive the integrated math CTE lessons in the Math-in-CTE study.

Further research documents the benefits of the integration of mathematics in the CTE curriculum. In 2008, an experimental study was conducted by Parr et al. (2008). The purpose of the study was to test the hypothesis of whether technical skills of students participating in the math-enhanced agricultural technology curriculum would not differ significantly from students who participated in the traditional curriculum. This experimental study consisted of CTE teachers and students in 38 Oklahoma high schools in the Spring semester of 2004. The data analysis established the math-enhanced agricultural power and technology curriculum and compatible instructional approach did not significantly decrease ($p > .05$) students' acquisition of technical skills. The researchers concluded that integration is a practical method of increasing student math achievement but the intervention needed to be over a longer time (Parr et al., 2008). Parr et al. concluded that integration is a practical method of increasing student math achievement, but the intervention needed to be over a longer period (Parr et al., 2008). McKim et al. (2016) and Tews (2011) agreed with Parr et al. that there needs to be literacy and math taught in CTE courses, especially agricultural education, to ensure that students get a comprehensive education and obtain proficiency or advance on state academic achievement assessments.

Several researchers (Mukembo & Edwards, 2015; Parr et al., 2019) agreed that mathematically-enhanced curriculum helps students improve comprehension of basic math concepts. In another study, Kiru et al. (2018) concluded interventions that incorporate features of explicit mathematics instruction can potentially enhance mathematics instruction and increase student mathematics achievement. These studies are

encouraging, indicating that the students who participate in intervention groups learned content that increased their mathematics knowledge, above and beyond increases that would exist by virtue of being in a typical traditional technology (CTE) class (Burghardt et al., 2010). This shows that it is possible for students to learn specific mathematical content knowledge in the content in a CTE classroom environment.

Effect of Curriculum Integration on Student Achievement

Whether it's in an elementary classroom, middle school, or secondary school setting, integration of ELA and math across the curriculum is a necessity in today's education system. The increasing need for high school graduates to possess critical thinking skills, collaboration abilities, creativity, and math and reading skills has increased the need for all stakeholders to recognize the objective of integration of ELA and math to prepare students for academic achievement and post-secondary transition.

The following review of literature shows that integrating literacy and numeracy can improve the overall reading and mathematical abilities of students in the secondary setting (Castellano et al., 2011; Partin, 2016). Castellano et al. (2011) conducted a longitudinal study on the impact of programs of study on academic and technical achievement in the secondary setting. Participants consisted of 9th and 10th graders from two districts in an experimental and quasi-experimental study. Castellano et al. concluded that curriculum integration was a beneficial instrument to engage students and incorporate rigorous academics into the CTE curriculum. In the final longitudinal study report, Castellano et al. (2014) added a third district and concluded there was a significant increase academically with curriculum integration and students' potential to transition

from school to career or college. Likewise, Partin (2016) revealed that in Arizona where explicit instruction was used to integrate academic content within CTE courses and teacher taught lessons aligned with the state's academic standards, CTE students performed significantly higher than the general high school population on the high stakes standardized academic test. The actual research on this topic is limited in the secondary setting; further research in the area of the effect of integration on student achievement is needed.

Summary and Conclusions

This chapter included a description of the search strategy and an overview of literature on literacy and math integration use in this literature review. The theoretical framework of explicit instruction used for this ex post facto quasi-experimental study was presented. Explicit instruction is based on the research developed by Archer and Hughes (2011). Explicit instruction, which is systematic, straightforward, engaging, and success-oriented, is one of the instructional tools available to educators in this pursuit of improving student performance (Buck, 2015; Pittman, 2014). Explicit instruction is beneficial when teaching new content that students would not discover without an understanding of the concept (Archer & Hughes, 2011; Polkinghorne & Hagler, 2012). Several researchers (Dennis et al., 2016; Gersten, Beckmann et al., 2009; Gersten, Chard et al., 2009; Hughes et al., 2017; National Mathematics Advisory Panel, 2008) agreed that using explicit instruction has a positive influence upon student academic achievement and gives struggling learners an advantage when learning to read or use new mathematics computations. The Authentic Literacy Applications in CTE study (Park et

al., 2010) and the Math-in-CTE researchers (Pearson et al., 2010; Stachler et al., 2013; Stone, 2013; Stone et al., 2008; Williams, 2013) demonstrated that integrating ELA and mathematics into CTE curriculum has a positive influence upon student academic achievement. Although some research has been conducted in the elementary school setting, there have only been a few studies on integrating curriculum in the secondary setting.

From the literature review, several themes emerged. The first theme is explicit instruction increases academic achievement (Freeman, 2017; Luke, 2014). The second theme was CTE teachers face the challenges of integrating literacy and math standards while increasing students' academic achievement as required by legislation (Bottoms, 2008; Cravens, 2020; Davoudi & Mahinpo, 2012; Meeder & Suddreth, 2012; National Business Education Association, 2013; Pearson, 2017; Wendt, 2013). A third theme is in order for CTE students to successfully achieve on standardized test and transition from school to career or college, CTE students needed literacy and math skills provided through integrating literacy and math curriculum.

Despite the legislation that mandated integration in CTE courses, there is limited knowledge about how CTE teachers integrated literacy and math standards in the high school curriculum. Another gap is little or no research information about the effect of an explicit instruction of literacy and numeracy curriculum in CTE Business courses on 10th grade first time test-taker CTE Business Education students' test scores in ELA and math. Therefore, this ex post facto quasi-experimental study was important to understand the

impact of an explicit instruction of literacy and numeracy in the CTE Business Education curriculum.

There was a gap regarding whether a CTE curriculum that integrated explicit instruction of literacy and numeracy had a significant effect on 10th grade first time test-taker CTE Business Education students' state standardized test scores. Therefore, this study will gather data concerning the effect of integrating explicit instruction of ELA and math in the CTE curriculum. An ex post facto quasi-experimental study was the most appropriate method to complete the data analysis of the HSAP scores.

Chapter 3: Research Method

The purpose of this ex post facto quasi-experimental study was to determine whether the CTE curriculum developed by a southeastern state school district that integrated explicit instruction in literacy and numeracy into CTE courses had a significant effect on 10th grade first time test-taker CTE Business Education students' academic achievement in ELA and mathematics as measured by state standardized test scores during the 2014-2015 school year. This chapter includes a description of the research method that was used for this quantitative study, including the research design and rationale, and the methodology. In addition, the sampling strategy and sampling procedures, procedures for recruitment, participation, the intervention, rationale for data collection and analysis will be described. This chapter concludes with a discussion of the threat to validity and ethical procedures related to the Institutional Review Board (IRB).

Research Design and Rationale

The research design for this quantitative study was an ex post facto quasi-experimental research design (Creswell, 2012). As Lodico et al. (2010) explain, "Ex post facto examines the effect of an *independent* variable (the past experience) on a *dependent* variable while controlling extraneous variables" (p. 13, emphasis added). The ex post facto quasi-experimental design was the best rational choice to answer my research questions. I used archived data of the student literacy and math scores for intact groups. The ex post facto quasi-experimental approach allowed me to examine, in retrospect, the effect of the independent variable (integration of explicit instruction of literacy and numeracy) on the dependent variables (HSAP standardized test scores for ELA and math

for 10th-grade CTE students) using previously collected archival data. The data consisted of archived 2014-2015 state standardized test scores for 10th grade CTE Business concentrators who experienced the treatment and for those who did not.

The district was required by legislation to develop a more effective local improvement plan align with state standards so that teacher could help students improve on performance in ELA and math for all CTE Business Education Content Areas to meet the State Department of Education Accountability Requirements on the HSAP standardized test. To accommodate students struggling with ELA and mathematics achievement on standardized achievement tests, the district began requiring CTE teachers to incorporate integration of explicit instruction of literacy and numeracy in their lesson preparation and delivery and update their lesson plans to indicate integration of explicit instruction of ELA and math activities.

For this study, I analyzed archival data of a census sample of 10th grade first time test-taker CTE Business Education students enrolled during the 2014-2015 school year to determine whether 10th grade CTE business students who were exposed to the treatment in 2014-2015 performed better on the ELA and Math HSAP standardized test than 10th grade CTE business students in 2014-2015 who were not exposed to the treatment.

Methodology

Population

The target population of this study was 220 10th grade first time test-taker CTE Business Education students enrolled in a business course who completed both of the HSAP ELA and HSAP Math tests during the 2014-2015 school year. The study sample

(*N* = 220) consisted of 10th grade first time test-taker CTE Business Education students at one local high school in the district, who took the HSAP standardized test during the 2014-2015 school year. Because the data for four students were not complete, the results were excluded from the study. The students were divided into two overall grouping categories: CTE students who were taught with the integrated curriculum (*n* = 62); and CTE students who were not taught with the integrated curriculum (*n* = 154) during the 2014-2015 school year. HSAP ELA and HSAP Mathematics standardized test scores for CTE students in the integrated (i.e., the treatment group) and non-integrated (i.e., the control group) was compared to determine whether, after treatment implementation in 2014-2015, there was a statistically significant difference between the HSAP ELA and HSAP Mathematics standardized test scores of the students who experienced the treatment and those who did not.

Sampling and Sampling Procedures

To ensure that the sample size (*N* = 220) CTE students would be appropriate for this research study, I used G*Power to conduct a power analysis to determine the observed power I could expect in my research (Faul et al., 2007). This power analysis was conducted to determine the probability of rejecting the null hypothesis when it is, in fact, not true (Cohen, 1988). To conduct the power analysis, I set the alpha risk level at α = .05 (two-tailed) and used the expected sample size of two nonequivalent groups (*N* = 220). Additionally, I used G*Power's guideline for medium effect size (*d* = 0.50; Faul et al., 2007). A medium effect size is reasonable given the exploratory nature of this study. Using these values (α = .05, *N* = 220, *d* = 0.50), my potential observed power would be

0.80 indicating an 80% probability of rejecting the null hypothesis when it is false, avoiding a Type II error. The sample size of (N = 220) was above the ideal sample size of 117 participants; therefore, the sample size was appropriate. I chose to use all deidentified data provided.

Creswell (2012) stated, "In nonprobability sampling, the researcher selects individuals because they are available, convenient, and represent some characteristic the investigator seeks to study" (p. 145). After I examined the data to determine whether Assumption 4 was met, it was determined that there were outliers: HSAP ELA cases 41, 47, 50, 189 and HSAP MATH cases 41, 42, 62, 112,189. All outliers were removed from the data sample after verifying the inputted test scores were accurate. Once the outliers were removed, the box plots were performed again.

After all outliers had been eliminated, the sample that resulted was comprised of HSAP ELA (N = 216) and HSAP Math (N = 215). The students were divided into two overall grouping categories: 10th grade first time test-taker CTE Business Education students who were taught with the integrated explicit instruction in literacy and numeracy curriculum for HSAP ELA (n = 62) and HSAP Math (n = 62); and CTE students who were not taught with the integrated explicit instruction in literacy and numeracy curriculum for HSAP ELA (n = 154) and HSAP Math (n = 153) during the 2014-2015 school year. HSAP ELA and HSAP Mathematics standardized test scores for CTE students in the integrated (i.e., the treatment group) and nonintegrated (i.e., the control group) were compared to determine whether there was a statistically significant

difference between the HSAP ELA and HSAP Math scores of the students who experienced the treatment and those who did not.

Procedures for Recruitment, Participation, and Data Collection

After receiving IRB approval (04-17-18-0321511) from Walden University and the participating Southeast region school district, data collection took place at a rural high school located in the southeast region. The process involved obtaining archival data of the standardized HSAP ELA and HSAP Math tests for 10th grade first time test-taker CTE Business Education students (a) CTE Business Education students who were taught with the integrated explicit instruction of literacy and numeracy curriculum; and (b) CTE students who were not taught using the integrated explicit instruction of literacy and numeracy curriculum. I obtained consent from the school district. I followed ethical procedures to obtain approval to conduct research. I contacted the authorized research representative at the district office to inquire about forms needed to conduct research in the district. I was informed that there was a Research and Information Sharing Agreement form required to obtain district approval (authorized research representative, personal communication, January 17, 2017). I completed the required form to obtain IRB approval to conduct research and collect archival data on HSAP test scores provided by the State Department of Education Office of Career and Technology Education (OCTE) in summary reports and archival data in student records to the target district. A data file containing HSAP ELA and HSAP Math scores of the 10th grade CTE Business Education students who tested during the 2014-2015 school year was provided. Confidentiality of all participants will remain a priority. Students were assigned a number

for identification purposes to maintain confidentiality and privacy. All archival HSAP test scores data received from the district were kept private in a password protected file and will only be kept for 5 years and then destroyed.

Treatment

The integration was comprised of 15-minute literacy lessons four times a week and 15-minute numeracy lessons one time per week called “Integration Activities” during the semester before the administration of the HSAP standardized tests. Teachers were directed to present the integration activities at the beginning or at the end of the class block to reinforce ELA concepts (e.g., utilize graphic organizers, concept ladders, and word maps) and math applications that students needed to know for the HSAP standardized test. Fidelity of the treatment was enforced. Teachers were required to submit weekly lesson plans to their assistant principal and the administrators did unannounced walk-through observations of teachers’ classroom to make sure the teachers were teaching the intervention lessons.

On the days designated for literacy treatment, teachers taught lessons using activities from the Literacy and Numeracy Handbook that was issued by the Career and Technology Education Director and on the day designated for math, teachers used math problems from the free Algebra 1 worksheets located on the https://www.kutasoftware.com/ website. These lessons served as the treatment and were designed to review standards for English 1 and Algebra 1 as mandated by the State Department of Education. The integrated lessons were designed to be taught using explicit instruction. CTE teachers were trained in the five steps of explicit instruction and

were expected to use the steps in the development of lesson plans. Each of these lessons contained integrated literacy concepts and math applications that align with the HSAP test. These lessons lasted unto the end of the semester before the HSAP standardized test was administered.

Literacy skills similar to HSAP Test Blueprint included (a) analyzing and evaluating text; (b) comparing and contrasting; (c) determining cause and effect relationships; (d) drawing conclusions and making inferences; (e) building vocabulary; (f) locating data; and (g) evaluating credibility of sources were covered on the days designated for literacy integration. Numbers and operations similar to proficiencies on the HSAP standardized test, including math formulas solving for average, standard deviation, maximum, minimum, interest, mortgage payments, and working with percentages, were covered on the days designated for numeracy integration. The integrated lessons were designed to enable students to demonstrate their literacy and math comprehension and expertise, as well as improve areas of weakness by working independently with the teacher and peer collaborating.

Archival Data

The school district in which this quantitative ex post facto study was conducted has a process in which Research & Information Sharing Agreement application must be submitted to a research committee. The Research & Information Sharing Agreement form was completed to obtain permission to use archival data. Approval was granted from the district test coordinator at the school district to conduct and to use the archived test scores. The data were provided by the participating school district in the form of a

confidential Excel file. The data file containing 10th grade first time test taker CTE Business Education students' HSAP ELA and HSAP Math scores were collected on deidentified individual students during the 2014-2015 school year.

Instrumentation and Operationalization of Constructs

The EAA of 1998 requires that the Department of Education "develop or adopt and administer standards-based assessments including a high school standardized test, which is to be first administered to students in their second year of high school regardless of their grade" (S.C. Code Ann. §§ 59-18-1300 and 59-139-10 *et seq*. Supp., 2004, p. 23). The former No Child Left Behind Act (NCLB) mandated, just as the current ESSA legislation mandates, that states must evaluate secondary school students' academic achievement in ELA, and mathematics (Civic Impulse, 2016; Klein, 2016).

HSAP test items were developed using the *State Curriculum Standards* for ELA and mathematics. In Spring 2003, field testing was conducted to generate an adequate number of test items for the HSAP ELA and mathematics tests. All test items met the knowledge and skills requirements for standardized tests assessment. The HSAP consists of two operational tests, one in English language arts and one in mathematics and required three days of test administration: two for ELA and one for mathematics. The test administrators received training for conducting HSAP testing. The HSAP results were reported as scale test scores. The reliability of the HSAP scores has been established through the consistency of results. HSAP has been administered for several years to high school sophomores. Their scores have been analyzed, and the results have yielded an accurate measurement of how the students perform in ELA and mathematics.

The independent variable (IV) of this study is the integration of explicit instruction of literacy (ELA) and numeracy (mathematics) instruction that was added to the CTE curriculum. The HSAP standardized test scores of 10th grade first time test-taker CTE Business Education students taught using integrated explicit ELA and math instruction, and the HSAP standardized test scores of 10th grade first time test-taker CTE Business Education students who were *not* taught with the integrated explicit ELA and math instruction will be used in determining whether there was a statistical difference between the standardized HSAP ELA and HSAP Math test scores of 10th grade first time test-taker CTE Business Education students who were enrolled in CTE Business Education classes with integrated literacy and numeracy instruction and the standardized HSAP ELA and HSAP Math test scores of 10th grade first time test-taker CTE Business Education students who were not enrolled in CTE Business Education classes with integrated literacy and numeracy instruction during the 2014-2015 school year.

Data Analysis Plan

The data were analyzed using Statistical Package for Social Sciences (SPSS), Version 27 for Windows software. Two research questions guided this ex post facto quasi-experimental study. The first asked: What is the statistical difference between the standardized HSAP ELA test scores of all 10th grade first time test-taker CTE Business Education students who were enrolled in CTE Business Education classes that integrated explicit literacy and numeracy instruction and the standardized HSAP ELA test scores of all 10th grade first time test-taker CTE Business Education students who enrolled in CTE Business Education classes that did not integrate explicit instruction in literacy and

numeracy during the 2014-2015 school year? The second research question asked: What is the statistical difference between the standardized HSAP Math test scores of all 10th grade first time test-taker CTE Business Education students who were enrolled in CTE Business Education classes that integrated explicit literacy and numeracy instruction and the standardized HSAP Math test scores of all 10th grade first time test-taker CTE Business Education students who were enrolled in CTE Business Education classes that did not integrate explicit literacy and numeracy instruction during the 2014-2015 school year?

The independent samples *t* test assesses whether the mean scores of two groups are statistically different from one another (Gay et al., 2012). The 10th grade first time test-taker CTE Business Education students who received the integrated explicit ELA and math curriculum and the 10th grade first time test-taker CTE Business Education students who were not exposed to the integrated explicit ELA and math curriculum qualify as separate, independent groups.

The independent-samples *t* test means is used to compare the mean score to a continuous variable for two disparate groups of subjects (Fraenkel & Wallen, 2006). Therefore, I used the independent-samples *t* test to determine whether there was a significant difference in the standardized HSAP test scores of all 10th grade first time test-taker CTE Business Education students who experienced the integrated explicit ELA and math instruction and standardized HSAP test scores of all 10th grade first time test-taker CTE Business Education who did not experience the integrated explicit ELA and math instruction during the 2014-2015 school year. The independent-samples *t* test was

used to determine whether there was a statistically significant difference between the two groups.

The HSAP ELA and HSAP Math achievement scores of the 10th grade first time test-taker CTE Business Education students were analyzed to find a mean (*M*) and standard deviation (*SD*). The mean scores of the samples were analyzed using SPSS software to determine if a statistically significant difference in ELA and math scale test scores was evident between the study groups. If the *p*-value was less than 5% ($p < 0.05$), I concluded that the null hypothesis could be rejected; however, if it exceeded the set alpha level, I failed to reject the null hypothesis (Triola, 2012).

Threats to Validity

The threats to validity raised by study include the presence of after school tutoring and experimental mortality. Throughout the study school, teachers provided non-mandatory after school tutoring three times a week. The after school tutoring sessions were available to anyone in the treatment or control group to participate in for one hour. The district requires teachers to write reflections about how the lesson was implemented or if any interruptions (e.g., school canceled; student and teacher attendance; school assembly) caused the omission of the integration for that day. Teachers were required to submit weekly lesson plans to their assistant principal and the administrators conducted unannounced walk-through observations of teachers' classroom to make sure the teachers were teaching the intervention lessons. Also, experimental mortality could be an internal threat because during the 6 weeks between the course completion of the treatment and

testing, students could have experienced some loss of learning. Some students are not able to retain information without practicing and reinforcing new learning skills.

For both study groups, there was not any issue of selection bias because students in the intact groups were used in the study. Steps to reduce the threat of external validity included ensuring that data from all 10th grade first time test-taker CTE Business Education students in the target population was collected and analyzed (Creswell, 2014). District officials are confident that the archived data in the district system is accurate. To reduce threats to internal validity, efforts have been made to ensure that all student data collected experienced the same HSAP assessment (Creswell, 2014). Threats to validity are arbitrated when research is specific about the actual time and population affected.

Construct Validity

Construct validity is the accuracy with which an instrument measures what it is supposed to measure (Creswell, 2014). The standardized HSAP test was designed to measure student achievement in concepts and skills based on state performance standards. The school district goes through a process each year with the Department of Education to verify all student data from the HSAP test. The verification of student data includes proficiency scores as well as student growth percentages. HSAP test items were developed using the state curriculum standards for ELA and mathematics. In spring 2003, field testing was conducted to generate adequate amount of test items for the HSAP ELA and mathematics tests. All test items met the knowledge and skills requirements for standardized tests assessment. The reliability of the HSAP scores has been established through consistency of results.

Ethical Procedures

It was necessary to gain permission from the focus school district before conducting research in their schools. The target study district required a copy of IRB approval in addition to a request to conduct research packet seeking permission to conduct research involving the school district. A formal letter was sent to the district test administrator asking for his permission to use the district's data in this research study. I also had to meet the requirements of the Walden University Institutional Review Board. Measures were taken to protect privacy and confidentiality including not identifying the district or the students. The district was identified as a rural school district in a southern state. I protected student identities by assigning numbers and removing student names.

Summary

In Chapter 3, I provided a description of the research methodology used to conduct the ex post facto quasi-experimental study. An ex post facto quasi-experimental study design was used to obtain and analyze the data that determined whether the CTE curriculum developed by a southeastern state school district that included explicit instruction of literacy and numeracy had a significant effect on 10th grade first time test-taker CTE Business Education students state standardized ELA and Math test scores. In Chapter 3, I provided an overview of the research design and rationale, population, sampling and sampling procedure, operationalization, data analysis plan, threats to validity, ethical procedures, and a summary were also presented in Chapter 3. In Chapter 4, data collection, treatment, and results will be provided.

Chapter 4: Results

The purpose of this ex post facto quasi-experimental study was to determine whether the CTE curriculum developed by a southeastern state school district that integrated explicit instruction in literacy and numeracy into CTE courses had a significant effect on 10th grade first time test-taker CTE Business Education students' academic achievement in ELA and mathematics as measured by state standardized test scores during the 2014-2015 school year. As stated in the previous chapter, archival data were collected from a sample (N = 216) participants. The outcomes of the study contribute to the limited literature on integrating literacy and numeracy in the CTE secondary setting. There is an academic deficiency in ELA and math across the nation.

In this quantitative research study, I analyzed the effect of one southeastern state school district's standardized HSAP ELA and HSAP Math test scores of all 10th grade first time test-taker CTE Business Education students who were enrolled in CTE Business Education classes that integrated explicit literacy and numeracy instruction and the standardized HSAP ELA test scores and HSAP Math test scores of all 10th grade first time test-taker CTE Business Education students who enrolled in CTE Business Education classes that did not integrate explicit literacy and numeracy instruction during the 2014-2015 school year. I compared archival HSAP scores of 10th grade first time test-taker CTE Business Education students who were exposed to the integrated explicit instruction literacy and numeracy curriculum to students' scores of 10th grade first time test-taker CTE Business Education students that were not exposed to the integrated

explicit instruction literacy and numeracy curriculum. The data collected were used to answer the two research questions:

RQ1: What is the statistical difference between the standardized HSAP ELA test scores of all 10th-grade first time test-taker CTE Business Education students who were enrolled in CTE Business Education classes that integrated explicit literacy and numeracy instruction and the standardized HSAP ELA test scores of all 10th-grade first time test-taker CTE Business Education students who enrolled in CTE Business Education classes that did not integrate explicit instruction in literacy and numeracy during the 2014-2015 school year?

$H_0$1: There is no significant difference between the standardized HSAP ELA test scores of all 10th grade first time test-taker CTE Business Education students who were enrolled in CTE Business Education classes that integrated explicit literacy and numeracy instruction and the standardized HSAP ELA test scores of all 10th grade first time test-taker CTE Business Education students who were enrolled in CTE Business Education classes that did not integrate explicit literacy and numeracy instruction during the 2014-2015 school year.

H_a1: There is a significant difference between the standardized HSAP ELA test scores of all 10th grade first time test-taker CTE Business Education students who were enrolled in CTE Business Education classes that integrated explicit literacy and numeracy instruction and the standardized HSAP ELA test scores of all 10th grade first time test-taker CTE Business Education students who were enrolled in CTE Business Education

classes that did not integrate explicit literacy and numeracy instruction during the 2014-2015 school year.

RQ2: What is the statistical difference between the standardized HSAP Math test scores of all 10th grade first time test-taker CTE Business Education students who were enrolled in CTE Business Education classes that integrated explicit literacy and numeracy instruction and the standardized HSAP Math test scores of all 10th grade first time test-taker CTE Business Education students who were enrolled in CTE Business Education classes that did not integrate explicit literacy and numeracy instruction during the 2014-2015 school year?

$H_0$2: There is no significant difference between the standardized HSAP Math test scores of all 10th grade first time test-taker CTE Business Education students who were enrolled in CTE Business Education classes that integrated explicit literacy and numeracy instruction and the standardized HSAP ELA test scores of all 10th grade first time test-taker CTE Business Education students who were enrolled in CTE Business Education classes that did not integrate explicit literacy and numeracy instruction during the 2014-2015 school year.

H_a2: There is a significant difference between the standardized HSAP Math test scores of all 10th grade first time test-taker CTE Business Education students who were enrolled in CTE Business Education classes that integrated explicit literacy and numeracy instruction and the standardized HSAP ELA test scores of all 10th grade first time test-taker CTE Business Education students who were enrolled in CTE Business Education

classes that did not integrate explicit literacy and numeracy instruction during the 2014-2015 school year.

In Chapter 4, the results of the study will be detailed and discussed. I describe data collection, data analysis, and results. The chapter ends with a discussion and interpretation of the results.

Data Collection

After receiving IRB approval (04-17-18-0321511) from Walden University and from the participating school district, archived HSAP test data were provided by the Office of Instruction District Test Coordinator for 10th grade first time test-taker CTE Business Education students who took the HSAP during the 2014-2015 school year from one rural high school in a southeastern United States' state school district. The data file provided HSAP ELA and HSAP Math test scores of deidentified individual students for 2014-2015 school year. The population of interest was 220 10th grade first time test-taker CTE Business Education students who completed both HSAP ELA and HSAP Math. The sample that resulted after outliers were removed was HSAP ELA (N = 216) and HSAP Math (N = 215). In both cases, HSAP ELA sample represented 98.2 % of the population of interest, and HSAP Math sample represented 97.7% of the population of interest. The data were imported into SPSS and all subsequent data manipulations and analyses were performed using IBM SPSS software (Version 27.0).

Treatment Fidelity

To ensure intervention was implemented as planned, every Monday by 8:00 AM, the trained CTE teachers were required to submit detailed lesson plans for the entire week

that showed the components of explicit instruction of the integration of ELA and math that would be taught in the CTE courses. Daily, the district required teachers to write reflections about how the lesson was implemented or if any interruptions caused the omission of the integration for that day. The school administration used these measures to monitor that the integrated treatment was occurring and the steps used to teach the integrated curriculum were delivered to all 10th grade first time test-taker CTE Business Education students in the treatment group. Teachers documented any disruptions or variations in the treatment in their lesson plans (e.g., high-stake testing, holidays, school canceled; student and teacher attendance; school assembly) that may have affected student performance on the HSAP assessment. There were no disruptions or variations in treatment plan as demonstrated in the lesson plans.

Results

The purpose of this ex post facto quasi-experimental study was to determine whether the CTE curriculum developed by a southeastern state school district that integrated explicit instruction in literacy and numeracy into CTE courses had a significant effect on 10th grade first time test-taker CTE Business Education students' academic achievement in ELA and mathematics as measured by state standardized test scores during the 2014-2015 school year. The data analysis plan required the use of an independent samples *t* test to test the null hypotheses. Before analyzing the data, I first determined that the data met the assumptions for the independent samples *t* test.

Assumption 1

Assumption 1 requires that the dependent variable be continuous. In this study, the dependent variables for each research question are the HSAP ELA and HSAP Mathematics standardized test scores for the year of 2014-2015 achieved by the students in each group of the IV. The use of *t* tests for scaled test scores of two disparate groups of subjects is acceptable (Fraenkel & Wallen, 2006). The data for HSAP scores met Assumption 1 because the scores are continuous.

Assumption 2

Assumption 2 requires that the independent variable is categorical with two groups. In this study, the independent variables (integration of explicit instruction of literacy and numeracy instruction in the CTE courses) are categorical and there are two groups for each independent variable. Assumption 2 was met because the independent variable is categorical with two groups.

Assumption 3

Assumption 3 requires that there is independence of observations which means that there is no relationship between the observations in each group of the independent variable. In this study, there were two categorical, independent groups for comparison (treatment and control) and the scores on the dependent variable were independent of each other which met Assumption 3.

Assumption 4

Assumption 4 requires that there are no significant outliers. In this study, the descriptive statistics show that the HSAP ELA and HSAP Math 10th grade first time test-taker CTE Business Education students' scores are clustered close to the mean, an

indication that there are no significant outliers. To confirm this, boxplots were generated in SPSS Statistics to determine any significant outliers for the *t* tests (Laerd Statistics, 2020). After evaluating the box plots, it was determined that there were outliers: HSAP ELA cases 41, 47, 50, 189 and HSAP MATH cases 41, 42, 62, 112,189. All outliers were deleted from the data after ensuring the analysis was correctly conducted and all the information accurately inputted. Once the outliers were removed, the box plots were performed again. All outliers had been eliminated. Assumption 4 was met because there were no significant outliers. Data from the 10th grade first time test-taker CTE Business Education students sample for HSAP ELA (N = 216) and HSAP Math (N = 215) were examined. The students were divided into two overall grouping categories: CTE students who were taught with the integrated literacy and numeracy curriculum for HSAP ELA (n = 62) and HSAP Math (n = 62); and CTE students who were not taught with the integrated literacy and numeracy curriculum for HSAP ELA (n = 154) and HSAP Math (n = 153) during the 2014-2015 school year.

Assumption 5

Assumption 5 requires that the data for each group of the dependent variable should be normally distributed. To test for this assumption, I conducted the Shapiro-Wilk test for normality. The Shapiro-Wilk test is more suitable for analyzing samples of less than 50 but can also process test sizes as extensive as 2000 (Hanusz et al., 2016). For this reason, the Shapiro-Wilk Test was utilized as the statistical instrument of evaluating normality (Hanusz et al., 2016; Razali & Wah, 2011). If the significance value is less than .05 the data are not normally distributed. Table 1 and Table 2 answer the question of

whether the frequency distribution is normal or not. The tables present the results from the Shapiro-Wilk test. Table 1 presents the Tests of Normality for ELA Achievement and shows that the significance value of *p* are 0.39 and .755 which are greater than the *p*-value of .05; therefore, the frequencies are normally distributed for Assumption 5.

Table 1

Tests of Normality for ELA Achievement Level

	Shapiro-Wilk		
Variable	Statistic	df	Sig.
Treatment Group	.980	62	.392
Control Group	.994	154	.755

Table 2 presents the Tests of Normality for Math Achievement and shows that the significance value of *p* are .532 and .089, which are greater than the *p* value of .05; therefore, the frequencies are normally distributed.

Table 2

Tests of Normality for MATH Achievement Level

	Shapiro-Wilk		
Variable	Statistic	df	Sig.
Treatment Group	.983	62	.532
Control Group	.985	153	.089

Assumption 6

Assumption 6 requires homogeneity of variance. In this study Levene's test for equality of variance evaluated the assumption that the population variances of the two groups were equal with a 95% confidence interval; the independent-samples *t* test is sensitive to the violation of this assumption (Statistics Solutions, 2019). The size of the *p* value indicated variance. A large *p* value ($p > .05$) indicated the variances were equal, and a small *p* value ($p < .05$) indicated unequal variance. To test for this assumption, I conducted Levene's test for equality of variances. The assumption of homogeneity of variances was violated for the HSAP ELA scale test scores ($p = .001$) and the HSAP Mathematics scale test scores ($p = .003$). The HSAP ELA gain scores between groups violated the assumption of homogeneity of variances, as assessed by Levene's Test for Equality of Variances ($F = 4.318$, $p = 0.039$). The HSAP Math gain scores between groups violated the assumption of homogeneity of variances, as assessed by Levene's Test for Equality of Variances ($F = 8.347$, $p = 0.004$). Therefore, I conducted the analysis using the t statistics for equal variances not assumed because the homogeneity of variances was violated for Assumption 6. The t statistics for equal variances not assumed is not affected by the difference in sample size for the two groups (Laerd Statistics, 2020).

Data Analysis

Descriptive statistics in Table 3 showed 62 of the 10th grade first time test-taker CTE Business Education students were exposed to the integrated explicit instruction in literacy and numeracy curriculum compared to 154 of 10th grade first time test-taker

CTE Business Education students who were not exposed to the integrated explicit instruction in literacy and numeracy curriculum. Table 3 presents descriptive data results of the 10th grade first time test-taker CTE Business Education students sample for HSAP ELA (N = 216).

Table 3

HSAP ELA Descriptive Statistics

Intervention	*N*	Mean	Std. Deviation	Std. Error Mean	Min	Max
Integrated	62	228.11	12.122	1.540	204	261
Nonintegrated	154	221.42	15.434	1.244	184	261

Note: The mean of HSAP ELA scores of the integrated group (M=228.11, SD =12.122) was larger than the mean of HSAP ELA scores of the nonintegrated group (M=221.42, SD = 15.434).

The data analysis plan required the use of an independent *t* test to test the null hypotheses. Descriptive statistics in Table 4 showed 62 of the 10th grade first time test-taker CTE Business Education students were exposed to the integrated explicit instruction in literacy and numeracy curriculum compared to 153 of 10th grade first time test-taker CTE Business Education students who were not exposed to the integrated explicit instruction in literacy and numeracy curriculum. Table 4 presents the descriptive data results of the 10th grade first time test-taker CTE Business Education students sample for HSAP Math (*N* = 215).

Table 4

HSAP MATH Descriptive Statistics

Intervention	*N*	Mean	Std. Deviation	Std. Error Mean	Min	Max
Integrated	62	215.76	12.176	1.546	188	241
Nonintegrated	153	209.47	17.516	1.416	170	250

Note: The mean of HSAP MATH scores of the integrated group (M=215.76, SD=12.176) was larger than the mean of HSAP MATH scores of the nonintegrated group (M=209.47, SD = 17.516).

In order to determine whether there is a statistically significant difference between the standardized HSAP ELA test scores of all 10th grade first time test-taker CTE Business Education students who were enrolled in CTE Business Education classes that integrated explicit literacy and numeracy instruction and the standardized HSAP ELA test scores of all 10th grade first time test-taker CTE Business Education students who enrolled in CTE Business Education classes that did not integrate explicit literacy and numeracy instruction during the 2014-2015 school year an independent samples *t* test for equal variances not assumed was conducted with a significance level of $p = .05$. The independent variables were integrated (integrated explicit instruction in literacy and numeracy into CTE courses), and nonintegrated CTE Business Classes and the dependent variable was HSAP ELA scale test scores for the year of 2014-2015.

As previously stated, nonprobability census sampling design was utilized to assemble intact groups of 10th grade first time test-taker CTE Business Education students who took the HSAP ELA and HSAP Math standardized test during the 2014-2015 school years (see Lodico et al., 2010). HSAP data from the 10th grade CTE student population were examined. Of these students, two groups were established: integrated and nonintegrated based on teacher class rosters. I chose to use all deidentified data provided by the district. Among 10th grade first time test-taker CTE Business Education students taking the HSAP ELA exam (N = 216), there was a statistically significant positive difference between the scores of the students who were enrolled in integrated explicit instruction in literacy and numeracy CTE classes (n = 62) and those students who were not enrolled in integrated explicit instruction in literacy and numeracy CTE classes (n = 154), Integrated Group (M=228.11, SD= 12.12) and Nonintegrated Group (M= 221.42, SD= 15.43), conditions; $t(142) = 3.381$, $p = .001$. Therefore, I rejected the null hypothesis that there is no significant difference in the HSAP ELA test scores of 10th grade first time test-taker CTE Business Education students who were enrolled in CTE Business classes with integrated explicit instruction in literacy and numeracy into CTE courses and the standardized HSAP ELA test scores of 10th grade first time test-taker CTE Business Education students who were not enrolled in CTE Business classes with integrated explicit literacy and numeracy instruction. The effect size for this analysis (d = .46) was a moderate effect according to Cohen (1988). Tenth grade first time test-taker CTE Business Education students who were enrolled in CTE Business Education classes

that integrated explicit literacy and numeracy instruction outperformed the students not enrolled on the HSAP ELA test scores.

In order to determine whether there is a statistically significant difference between the standardized HSAP Math test scores of all 10th grade first time test-taker CTE Business Education students who were enrolled in CTE Business Education classes that integrated explicit literacy and numeracy instruction and the standardized HSAP Math test scores of all 10th grade first time test-taker CTE Business Education students who were enrolled in CTE Business Education classes that did not integrate explicit literacy and numeracy instruction during the 2014-2015 school year, an independent samples *t* test for equal variances not assumed was conducted. Among 10th grade first time test-taker CTE Business Education students taking the HSAP Math exam ($N = 215$), there was a statistically significant positive difference between the mean scores of the students who were enrolled in integrated CTE Business Education Classes ($n = 62$) and those students who were not enrolled in integrated CTE Business Education Classes ($n = 153$), Integrated Group ($M = 215.76$, $SD = 12.18$) and Nonintegrated Group ($M = 209.47$, $SD = 17.52$), conditions; $t(161) = 3.000$, $p = .003$. Therefore, I rejected the null hypothesis that states there is no significant difference between the standardized HSAP Math test scores of all 10th grade first time test-taker CTE Business Education students who were enrolled in CTE Business Education classes that integrated explicit literacy and numeracy instruction and the standardized HSAP ELA test scores of all 10th grade first time test-taker CTE Business Education students who were enrolled in CTE Business Education classes that did not integrate explicit literacy and numeracy instruction during the 2014-

2015 school year. Cohen's (1988) effect size value of d = .39 suggests the effect was small. Any effect size above d = .20 is still a positive effect for HSAP Math and suggests a low practical significance. Students who were enrolled in CTE Business classes that integrated explicit literacy and numeracy instruction outperformed the students not enrolled in the CTE Business classes with integrated explicit ELA and mathematics instruction on the HSAP ELA test scores.

Summary

Chapter 4 presented the results of the analysis and answered the research questions. The purpose of this ex post facto quasi-experimental study was to determine whether the CTE curriculum developed by a southeastern state school district that integrated explicit instruction in literacy and numeracy into CTE courses had a significant effect on 10th grade first time test-taker CTE Business Education students' academic achievement in ELA and mathematics as measured by state standardized test scores during the 2014-2015 school year. To answer the research questions, I conducted an independent t test for equal variances not assumed. As stated previously, Cohen's (1988) effect size value of d = .46 suggests a moderate effect for HSAP ELA standardized test. Therefore, with a Cohen's d = 46, there is a 62.8% chance that a student picked at random from the integrated group will have a higher score than a person picked at random from the nonintegrated group for the integrated literacy treatment (Ellis, 2010; Sun et al., 2010). Results from the independent t test for equal variances not assumed HSAP ELA test scores of all 10th-grade first time test-taker CTE Business Education students who were enrolled in CTE Business Education classes that integrated explicit literacy and

numeracy instruction and the standardized HSAP ELA test scores of all 10th-grade first time test-taker CTE Business Education students who enrolled in CTE Business Education classes that did not integrate explicit instruction in literacy and numeracy during the 2014-2015 school year provided enough evidence to reject the null hypothesis and accept the alternative hypothesis. Tenth grade first time test-taker CTE Business Education students who were enrolled in CTE Business Education classes that integrated explicit literacy and numeracy instruction had significantly higher standardized HSAP ELA test scores than the 10th grade first time test-taker CTE Business Education students who were not enrolled. Likewise, 10th grade first time test-taker CTE Business Education students who were enrolled in CTE Business Education classes that integrated explicit literacy and numeracy instruction had significantly higher HSAP Math test scores than 10th grade first time test-taker CTE Business Education students who were not enrolled in CTE Business Education classes that integrated explicit literacy and numeracy instruction. As stated previously, Cohen's (1988) effect size value of $d = .39$ suggests a small effect for HSAP Math standardized test. Therefore, with a Cohen's $d = .39$, 65.2% of the integrated group will be above the mean of the nonintegrated group, there is a 60.9% chance that a person picked at random from the integrated group will have a higher score than a person picked at random from the nonintegrated group for the numeracy treatment (Ellis, 2010; Sun et al., 2010).

Chapter 5 includes the summary of the study and conclusions about the findings. In Chapter 5, I will also discuss interpretations of these findings, the limitations of this study, and future recommendations for continued research in this area.

Chapter 5: Discussion, Conclusions, and Recommendations

The purpose of this ex post facto quasi-experimental study was to determine whether the CTE curriculum developed by a southeastern state school district that integrated explicit instruction in literacy and numeracy into CTE courses had a significant effect on 10th grade first time test-taker CTE Business Education students' academic achievement in ELA and mathematics as measured by state standardized test scores during the 2014-2015 school year. Guided by the theory of explicit instruction and using an ex post facto quasi-experimental design, this quantitative study investigated whether the CTE curriculum developed by a southeastern state school district that included explicit instruction of literacy and numeracy had a significant effect on 10th grade first time test-taker CTE Business Education students' state standardized ELA and Math test scores. This study contributes to the limited literature regarding the effect of an integrated explicit instruction of literacy and numeracy curriculum on CTE students' academic achievement.

I used the ex post facto quasi-experimental research design to conduct the study. The HSAP was administered to 10th grade first time test-taker CTE Business Education students during mid-March 2015. I used the results of the HSAP ELA and HSAP Math assessments for the data analysis. My data analysis found that there was a significant statistical difference between the standardized HSAP ELA and HSAP Math test scores of all 10th grade first time test-taker CTE Business Education students who were enrolled in CTE Business Education classes with integrated explicit instruction of literacy and numeracy and the standardized HSAP ELA test scores of all 10th grade first time test-

taker CTE Business Education students who were not enrolled in CTE Business Education classes with integrated explicit instruction of literacy and numeracy.

Interpretation of the Findings

These study findings align with other results reported in the literature (see Costley, 2015; Gersten, Chard, et al., 2009; Stone et al., 2008; Wall & Leckie, 2017) suggesting that students who are exposed to an integrated curriculum achieved statistically higher scores compared to students not exposed to an integrated curriculum. In this study, the integrated CTE courses made a significant positive difference on the CTE student achievement in ELA and mathematics as measured by HSAP scores. Likewise, the findings of this research study confirmed the significance of including explicit instruction of literacy and numeracy into CTE Business Education curriculum to achieved significantly higher ELA and mathematical scores of CTE students, as was previously identified by other researchers (Anderson & Anderson, 2012; Fletcher et al., 2018; Goodman et al., 2013; Mellard et al., 2012, 2016; Pierce & Hernandez, 2015). CTE students are able to achieve higher scores on standardized tests when academic integration in CTE courses occur (Mellard et al., 2012, 2016; Pierce & Hernandez, 2015).

The theoretical framework for this study was based on Archer and Hughes's (2011) theory of explicit instruction. Archer and Hughes argued that explicit instruction was a clear and precise approach to teaching that included reviewing prior knowledge using a hook, modeling skills to break down steps in small parts, using guided practice, and providing feedback during independent practice. Archer and Hughes's theory is based on the fundamental foundation that all children can learn successfully if taught

competently. This study investigated whether the CTE curriculum developed by a southeastern state school district that included explicit instruction of literacy and numeracy had a significant effect on 10th grade first time test-taker CTE Business Education students' state standardized ELA and Math test scores. Archer and Hughes's theory is important to this study because it helped guide the CTE teachers in implementing CTE curriculum that included explicit instruction of literacy and numeracy to make a statistical difference on CTE students' academic achievement on the standardized test.

Explicit instruction is beneficial in helping students learn the content, think critically, and understand the objectives of the standards (Comber, 2013; Coyne et al., 2009; Gottfried et al., 2016; McIntyre & Hulan, 2013). The study examined whether the CTE curriculum developed by a southeastern state school district that included explicit instruction of literacy and numeracy had a significant effect on 10th grade first time test-taker CTE Business Education students' state standardized ELA and Math test scores. The statistical difference in HSAP ELA and HSAP Math test scores of 10th grade first time test-taker CTE Business Education students who received the intervention showed that implementation of explicit instruction of literacy and numeracy into CTE curriculum had an effect on ELA and math standardized test scores.

In this study, CTE students exposed to the intervention had a significant positive difference of their ELA and math achievement academic scores. The findings from the study supported the use of explicit instruction to teach the literacy and mathematical skills that were required for academic success (Luke, 2014; Satsangi, Hammer, &

Evmenova, 2018; Satsangi, Hammer, & Hogan, 2018). As stated previously, Cohen's (1988) effect size value of d = .46 suggests a moderate effect for HSAP ELA standardized test and effect size value of d = .39 suggests a small effect for HSAP Math standardized test. The effect size of the treatment for HSAP ELA suggested a moderate practical significance. Although the results showed the effect size of the treatment was small for HSAP Math, it is still a positive effect size and suggested a low practical significance. These effect sizes suggest that compared to the traditional approach (i.e., "instruction as usual"), the integrated explicit instruction in literacy and numeracy approach offers some practical positive benefits for students as measured by their achievement scores on the HSAP test and should be an approach that schools should consider (Ellis, 2010; Sun et al., 2010).

Limitations of the Study

This study was limited to the 10th grade first time test-taker CTE Business Education students who took the standardized HSAP test; therefore, it is unknown if the intervention would be effective in other groups of students. Only CTE student data was drawn for this study; therefore, the study can only be generalized for this set of 10th grade first time test-taker CTE Business Education students, and cannot legitimately make any conclusions about all high school students. Another limitation was there was not any way I could control how well the teachers implemented the curriculum.

Also, I could not manipulate the independent variable because the treatment had already occurred. I did not have complete control monitoring teachers or students because the administration monitored who was in each of the classes, and retained knowledge of

the participants' previous achievement in ELA and math. Another limiting factor in this study was the examination of a single southeastern state school district. The findings of this study were also limited by the duration of the treatment, which was five months of only doing explicit instruction for 15 minutes once a day each week. Some students may need more time to practice and fully develop concepts. Measures (see Chapter 4 for the description of the treatment fidelity) were utilized to ensure that the integrated treatment occurred and teachers documented any disruptions or variations in the treatment in their lesson plans (e.g., high-stake testing, holidays, school canceled; student and teacher attendance; school assembly) that may have influenced student performance on the HSAP assessment. Another limitation would be that I do not know if the students may have been receiving explicit instruction in other settings or if the students were getting ELA or math instruction outside the CTE classroom. Another limitation would be that I do not have any way to know if there were ELA and math achievement differences between the integrated explicit instruction in literacy and numeracy group and nonintegrated explicit instruction in literacy and numeracy group prior to the treatment. Lastly, there was a lack of research literature on CTE content area in this state and across the nation. These potential limitations were acknowledged when interpreting the results and their generalizability.

Recommendations

My results showed that there was a significant difference between the standardized HSAP ELA test scores of all 10th grade first time test-taker CTE Business Education students who were enrolled in CTE Business Education classes that integrated

explicit literacy and numeracy instruction and the standardized HSAP ELA test scores of all 10th grade first time test-taker CTE Business Education students who were enrolled in CTE Business Education classes that did not integrate explicit literacy and numeracy instruction during the 2014-2015 school year. I recommend further examination of potential outcomes of integrated explicit literacy and numeracy instruction within the sample district. For example, this study was conducted in Business Education classes; more research is needed to determine the effect of integrated explicit literacy and numeracy instruction in other academic content areas (e.g. agricultural, art, computer science, family consumer science, science) throughout the southeastern state. This study could be expanded to disaggregate the results by the independent variables of attendance, gender, race/ethnicity, and socioeconomic status of students. I recommend that future researchers consider examining multiple grade levels over an entire school year. For example, use data that examine integrated explicit instruction in literacy and numeracy across all content areas by grade level and using a longer time frame for the intervention than one school semester. Lastly, I would recommend that future researchers consider examining the same topics with qualitative approach so results can be explained in more detail using qualitative focus groups to give a voice to the participants. For example, a qualitative approach could explore with open-ended questions whether or not the students and teachers believed the integrated explicit literacy and numeracy instruction was beneficial. Also, students and teachers could share their thoughts on improving the treatment.

Implications

The positive outcomes found in this study hold the potential for positive social change at the organizational, and societal/policy levels. At the organizational level, the results of the study demonstrate that the CTE curriculum developed by a southeastern state school district that included explicit instruction of literacy and numeracy had a significant effect on 10th grade first time test-taker CTE Business Education students' state standardized ELA and Math test scores. In this study, CTE Business Content Area teachers integrated explicit instruction of literacy and numeracy in the curriculum, with the 10th grade first time test-taker CTE Business Education students that they taught. The results of explicit instruction of literacy and numeracy treatment showed there was a significant positive difference of moderate effect on HSAP ELA and significant positive difference of small effect on HSAP Math as measured by state standardized test scores.

This study can lead to social/policy change at the district and school level by providing knowledge of the effect of including integrated explicit instruction in literacy and numeracy in CTE content areas. As CTE Business Education teachers improve their skills in implementing integrated explicit literacy and numeracy in the CTE curriculum, CTE Business Education students will be better prepared to transition from school to career or college (Hopwood et al., 2016). Proficiency in ELA and math will be beneficial whether CTE Business Education students extend their education by enrolling in an institution of higher education or enter the workforce directly after high school graduation.

Conclusion

The outcomes of the study contribute to the currently limited literature about integrated explicit instruction in literacy and numeracy in CTE curriculum in secondary settings. The analysis determined that that 10th grade first time test-taker CTE Business Education students who were enrolled in CTE Business classes with integrated explicit literacy and numeracy instruction had statistically higher scores on the standardized HSAP ELA ($t = 3.381$; $p = .001$) and HSAP MATH ($t = 3.000$; $p = .003$) test than the 10th grade first time test-taker CTE Business Education students who were not enrolled in CTE Business classes with integrated explicit literacy and numeracy instruction.

Student achievement in literacy and math will continue to be a concern as schools strive to meet local, state, and federal mandates and standards. This study provided evidence that integrating explicit literacy and numeracy instruction in CTE Business Education curriculum resulted in a statistically positive difference between students who were exposed to the integrated curriculum and students that were not exposed as measured by state standardized test scores in ELA and mathematics. The State Department of Education, school district, administrators, and teachers need to continue working together to integrate explicit literacy and numeracy curriculum to improve CTE student achievement in ELA and math while equipping CTE students to make a successful transition from school to career or college.

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