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A CORRELATIONAL STUDY OF EMERGING MODALITIES OF DEVELOPMENTAL
EDUCATION AND LEARNING STYLES IN A FLORIDA STATE COLLEGE

by

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A dissertation submitted in partial fulfillment of the requirements
for the degree of Doctor of Educational Leadership
in the College of Education and Human Performance
at the University of Central Florida
Orlando, Florida

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Major Professor: Thomas Cox

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ABSTRACT

Developmental education course modalities in Florida were drastically changed in 2013 with the passage of Senate Bill 1720. These courses can no longer be offered in a traditional 16-week format as other postsecondary courses are offered. Developmental education courses must now be offered in a compressed, contextualized, or corequisite instruction modality; or direct enrollment into a gateway course (1720-Education, 2013). This changes the student's experience in the courses. This research was framed by Kolb's experiential learning theory, which states that people learn through their experiences (Kolb, 1984). Chi-Square correlational tests were conducted to examine the relationship between students' learning types and their final grades in an accelerated developmental math course and in a combined developmental math course. The results indicate no statistically significant relationships between the variables in both modalities of developmental math. Furthermore, students were surveyed on their preferences of the developmental math modalities. The results showed positive preferences toward both modalities of developmental math. With the limited amount of research in the area of developmental math modalities, this research helps to further understand the area and provides a basis for future research.

Dedicated to my wife Kaley and daughter Avery.
Thank you all for your love and support during this journey.

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LIST OF ABBREVIATIONS

The abbreviations that were given throughout this study are as follows:

AC - Abstract Conceptualization

AE - Active Experimentation

ALP - Accelerated Learning Program

CE - Concrete Experience

CUNY - City University of New York

ESL - English as a Second Language

FCS - Florida College System

GCC - Guilford Community College

GED - General Education Diploma

GPA - Grade Point Average

IBE - Integrated Business Experience

LSI - Learning Style Inventory

MBTI - Myers-Briggs Type Indicator

MOOC - Massive Open Online Course

PBL - Project Based Learning

RO - Reflective Observation

SAT - Scholastic Aptitude Test

SPSS - Statistical Package for Social Sciences

VAK - Visual Auditory Kinesthetic Learning Style Test

VARK - Visual Auditory Reading/Writing Kinesthetic Learning Style Test

CHAPTER ONE: INTRODUCTION

General Background

According to Bettinger, Boatman, and Long (2013), “Students often arrive at college facing multiple challenges, including inadequate academic preparation, competing obligations to work and family and limited experiences navigating the complexities of collegiate systems and requirements” (p. 94). In order to compensate for students’ lack of academic preparation, colleges and universities offer developmental education, also known as remedial education. According to Florida Statute 1008.02 (2013), developmental education is defined as “instructions through which a high school graduate who applies for any college credit program may attain the communication and computation skills necessary to successfully complete college credit instruction.”

Learning assistance programs began in the mid-1800s (Arendale, 2010). These were the closest thing to developmental education at the time. In the 1960s, American higher education became more democratized with the Civil Rights movement (McCabe, 2000). Civil rights provided more access to college but also allowed for academically deficient students to take college level courses. To be able to serve underprepared students, courses had to be designed to help underprepared students succeed. Increased access to college eventually led to remedial courses (McCabe, 2000). Remedial education became especially important at community colleges because of their open-access missions. While community colleges were allowing more students into their institutions, they had to determine who was college-ready and who was not. Assessments were offered to students entering colleges and universities as a way to determine college readiness.

Today, assessment testing is still the primary source through which institutions determine college readiness. According to Byrd and MacDonald (2005), college readiness is the understanding of a student's abilities to be successful in college. However, college readiness assessments have been shown to be inaccurate (Bailey, 2009). College readiness is something that cannot be determined by a single test (Camara, 2014). According to Komarraju, Ramsey, and Rinella (2013), high school GPA is the best indicator of college readiness. Furthermore, standardized tests have a strong correlation with academic self-confidence (Komarraju, Ramsey, & Rinella, 2013). While academic standards are important in determining college readiness, non-cognitive factors must also be considered. Self-concept, self-appraisal, long term goal setting, having a mentor, and community service can all play a role in determining if a student is college-ready (Sommerfield, 2011).

To better prepare high school students, different intervention programs need to be provided during high school to improve college readiness (Venezia & Jaeger, 2013). Current programs like the federally funded TRIO program help students from low-income backgrounds receive assistance such as tutoring in order to be prepared for college. In addition to TRIO, high schools that offer college level courses give students an understanding of what college culture is like (Venezia & Jaeger, 2013). Additionally, dual enrollment programs allow students to earn college credit while in high school. However, students enrolled in dual enrollment programs have not shown consistent success when entering college after high school graduation (Venezia & Jaeger, 2013).

In Florida, developmental education is directly tied to college and career readiness (Florida Department of Education, n.d.). According to the Department of Education (n.d.),

“students are considered college and career ready when they have the knowledge, skills, and academic preparation needed to enroll and succeed in introductory college credit-bearing courses within an associate or baccalaureate degree program without the need for remediation.” There are 28 state or community colleges in Florida that make up the Florida College System (FCS), which is commonly referred to as the FCS (The Florida College System, 2015). FCS schools are primarily two-year institutions that specialize in associate degrees. Prior to Senate Bill 1720, each college could assess what college-ready was for their students and base assessment tests on their own definitions.

In the past, students in Florida were required to take assessment tests to determine if they were ready for college-level courses or needed to take developmental education courses. Members of the FCS were the only institutions that had to be concerned with assessment testing. Students who entered four-year institutions were considered college-ready. Unlike college level math and English, developmental courses do not count for college credit. The purpose of developmental education is to strengthen math, reading, and English skills for students who are not yet college or career ready. However, the literature on developmental education’s success has been highly variable (Attewell, Lavin, Domina, & Levey, 2006; Crisp & Delgado, 2014; Doyle, 2012). While some scholars support developmental education’s purpose, other scholars reference literature that show the majority of students who enroll in developmental education are unsuccessful long term (Bailey et al., 2010).

More than half of the students who enroll at community colleges will take developmental education coursework (Bailey et al., 2010). Many students who take developmental education at community or state colleges will not transfer (Bailey et al.,

2010). The problem may not be the developmental courses but the length of time a full sequence of coursework can take. The data collected in Bailey, Jeong, and Cho's (2010) research was the Achieving the Dream data set. These data were compiled from 80 different colleges across 15 states from 2004-2009. The participating institutions gave longitudinal information on their students to help educators better understand students in state and community college systems. The results showed only 46% of developmental reading students were finishing their course sequences and only 33% of developmental math students were finishing their sequences (Bailey et al., 2010). However, if students did make it through their developmental course sequences, 50% went on to complete the corresponding college level courses (Bailey et al., 2010).

There are multiple reasons as to why a student is unsuccessful in developmental courses (Doyle, 2012). Students often have other responsibilities in their personal lives that can contribute to them not being successful. Family is usually one obligation that a student may have that results in time being taken away from their coursework. Employment can also present a challenge for students as it can take up so much of their time.

Retention and transfer rates of developmental education students are low. This has led to the creation of new policies to either eliminate or fundamentally change developmental education. These changes are happening nationwide, including in the state of Florida (Complete College America, 2014).

In 2013, State Senator Bill Galvano of Florida introduced Senate Bill 1720 that passed into law on July 1, 2013. This bill allows for any student who entered a Florida public high school in 2003 or later and went on to graduate from a Florida public high school the

ability to decline assessment for math and English and go straight into college level math and English (1720-Education, 2013). Active military students are also exempt from having to take assessment testing in Florida. In addition to letting students bypass assessment for developmental coursework, Senate Bill 1720 made colleges and universities change the way they offer developmental courses. Students who are required to take developmental courses must now take them in one of several modalities, including modularized instruction, compressed instruction, contextualized instruction, corequisite instruction, or as a gateway course (1720-Education, 2013).

Modularized instruction is a course that is offered in multiple modules so students can learn at their own pace. Compressed instruction is any full-term course, or a combination of multiple courses, that has been shortened in length but not in content. Contextualized instruction is any course that offers hands-on learning along with traditional classroom instruction. Corequisite instruction is when two separate courses are offered separately but must be taken together. Lastly, gateway courses are introductory courses that have high enrollment and lead directly into the subsequent courses.

Senate Bill 1720 allows any student who has attended a Florida public high school in 2003, and going on to graduate in 2007 or later to bypass assessment testing. However, any student who does not qualify to bypass assessment, can still be required to test. If a student has attended a private high school, gone to high school outside the state of Florida, been home schooled, or received a General Education Diploma, they can be required to complete an assessment test. Lastly, if one of these students does not place into college level courses, they then can be required to take one of the emerging modalities of developmental education.

Developmental education's effectiveness has been questioned since the 1970s by both faculty and students (Hampton, 1979). According to Hampton (1979), students who were interviewed felt that developmental education could be beneficial but that the modality that was offered was not effective. Students stated that accelerating the courses could possibly increase success in the courses (Hampton, 1979).

Increasingly, colleges across the country are making changes to the way developmental courses are offered (Venezia & Hughes, 2013). These changes, in some cases, are being mandated by the states. In order to improve students' success in developmental education courses, states are making a push to either eliminate traditional modalities or change developmental education into new modalities. The modalities created most often include corequisite instruction, compression, and modularization (Venezia & Hughes, 2013).

While the success of developmental education has been questioned since the 1970s, the movement to eliminate or alter developmental education is fairly new. Within the last decade, lawmakers have argued that developmental education has not been successful in retention and graduation (Complete College America, 2014). With support from politicians, 32 states have either altered or eliminated their developmental education programs. In California, the California Basic Skills Initiative was created and designed to accelerate students' path through developmental education (Venezia & Hughes, 2013). Virginia and North Carolina have also accelerated developmental reading courses.

Some scholars believe that other intervention programs could be created to offer additional support to developmental education students (Radford, Pearson, Ho, Chambers, & Ferlazzo, 2012). These support systems could be applied by changing the formats of the class

or offering supplemental assistance outside of the class. According to Bailey (2009), if students who are not college-ready are enrolling into college-level courses, they need to be provided with additional support. Furthermore, this population of students should be provided with workshops that can build on the areas with which they need development (Bailey, 2009). The workshops would be similar to developmental courses but the students would still be in the credit-bearing courses. According to Bailey (2009), the workshops would not be part of the curriculum, but rather a support system to a student who needs additional development.

The required changes to Florida's developmental education courses have resulted in differing results according to the literature. This study will examine the relationships that exists between student learning styles and academic success in an accelerated modality of developmental education and a combined modality of developmental education. Both of these courses meet Florida's new requirements by being offered in compressed modalities. This knowledge can help colleges and universities make decisions about developmental course modalities in the future.

Statement of the Problem

The original mission of the community college in Florida was to provide a postsecondary education to anyone living in the state (Albertson & Wattenberg, 1998). In order to meet this objective, the state's goal was to create community colleges that were within an hour's drive of 99% of the population. The Florida state government also wanted to provide an affordable option to citizens by offering lower tuition than the surrounding

universities (Albertson & Wattenberg, 1998). This led to the open-access mission of the community colleges in the early 1970s.

Since Senate Bill 1720 passed into law in 2013, there has been uncertainty surrounding its effects on students and the colleges that have traditionally assessed college readiness for students. Senator Galvano, who backed the bill, claimed it would advance students through college and ultimately lead to more students transferring to universities and graduating with a bachelor's degree. Legislators explain that students who are starting in developmental education are not successful in graduating college (Fain, 2013).

The alternative that is being provided for developmental education instruction is changes in course modalities. The little research that has been conducted on the compression of developmental education has been positive (Venezia & Hughes, 2013). However, because these changes are fairly new in Florida there has not been much research conducted.

In order to understand how compressing developmental education effects students' success rates, more research is needed (Venezia & Hughes, 2013). Furthermore, in some studies, students volunteered to take the compressed courses, which could have had an impact on the validity of the studies because the students were not randomly selected (Jaggars, Hodara, Cho, & Xu, 2015). Providing an understanding of relationships between students and their success in compressed modalities of developmental education courses is important. Furthermore, because Florida is requiring these course modalities, it is imperative that more research is conducted to provide information for colleges.

Significance

There is ongoing reform nationwide with developmental education. Senate Bill 1720 is Florida's version of reform. Because of these bills, there is little evidence as to whether or not it has had a positive or negative impact on retention and persistence of students. Furthermore, while some of the research conducted across the nation on the acceleration of developmental education has been positive, there is still not enough research to truly determine whether or not accelerated developmental education is effective (Venezia & Hughes, 2013). It is important that more research be conducted in this area to gain better understanding on the issue for governments, colleges, and students who are required to enroll in the courses.

The majority of students who enroll in developmental education courses are minorities (Koski & Levin, 1998). Only 35% of students entering two-year institutions are Caucasian while 65% are minorities (Attewell et al., 2006). Also, 22% of developmental education students' families make \$20,000 or less in a given year (Koski & Levin, 1998), while 43% of students enrolled in college-level coursework come from families making \$50,000 a year or more (Koski & Levin, 1998).

At community and state colleges, as many as 40% of students are first generation in college (Leeder, 2013). These high numbers contribute to community college's missions to give everyone an equal chance at a college education through open access. Community colleges mainly focus on teaching and learning, rather than research like a traditional university (Leeder, 2013). Student success and retention are also important aspects of community colleges. Developmental education attempts to ensure quality teaching and

standards are upheld at community colleges (Leeder, 2013). Furthermore, it is important that these courses continue to be offered at community colleges (Leeder, 2013).

Different programs conducted at community colleges across the nation have shown success in accelerating remedial education, including Chabot College's FastStart program (Jaggars et al., 2015). This program demonstrated success in accelerated math, with students showing an 11% increase in their success in these courses. However, more research is needed to determine why students are showing success in these courses. Additionally, with states now mandating these changes, some students will not have the option to take traditional developmental education courses. Thus, it is important to continue researching developmental education modalities, and what types of students are successful and what types are not.

Conceptual Framework

This study was framed with Kolb's (1984) theory on experiential learning. Kolb (1984) named his theory, experiential learning theory, for two major reasons. The first reason was to credit Dewey, Lewin, and Piaget in building his theory from their work (Kolb, 1984). The second reason is Kolb believed people learn through the experiences that they have in their lives (Kolb, 1984).

The experiential learning theory by Kolb is broken down into four cyclical modes including concrete experience, reflective observation, abstract conceptualization, and active experimentation (Kolb, 1984). The four modes work continuously together to explain how

learning occurs. While these four modes are cyclical, a person can show a preference towards the modes (Kolb, 1984). Each of these modes is described in more detail below.

Concrete experience refers to the participation that occurs during the experience (Kolb, 1984). When applied to students, this would be actually taking the developmental or college-level courses. Reflective observation refers to watching what is happening during the experience (Kolb, 1984). In the case of students, watching the faculty teach and reflecting on what is taught would be an example of reflective observation. During the experience in the class students would need to think and form concepts, which is also known as abstract conceptualization (Kolb, 1984). Lastly, the students would need to test their skills in this environment and see if they work, which is known as the fourth stage, active experimentation (Kolb, 1984).

These modes can be seen along two different dimensions: perceiving and processing (Kolb, 1984). Perceiving takes place when the learner is experiencing either concrete experience or abstract conceptualization. Processing take place when the learner is experiencing reflective observation or active experimentation. A learner will show a preference towards one of the two stage of each dimension, this determines their learning style.

The learning style of an individual can be examined as the combination of a person's stage combined with one of the two dimension. Kolb's learning styles are known as divergers, assimilators, convergers, and accommodators. Divergers prefer concrete experience and reflective observation. Assimilators show a preference for abstract concepts

and reflective observation. Convergers prefer abstract concepts and active experimentation. Lastly, accommodators prefer concrete experience and active experimentation (Kolb, 1984).

The Kolb Learning Style Inventory was developed to measure what type of learner a person is based on his or her preferences in experiential learning (Kolb & Kolb, 2005). The instrument is comprised of 12 open-ended statements that participants answer on a one through four scale, with one being the least and four being the greatest. Through their answers, participants will show a preference toward two of the continuous modes of learning and can be categorized into one of the four learning types (Kolb & Kolb, 2005). Kolb's experiential learning theory and instrument were chosen because students are experiencing different modalities of learning for the same courses. This instrument will be able to identify a student's learning style.

Research Questions

This study was guided by the following questions.

1. Is there a relationship between learning style and academic achievement in a combined modality of developmental math and an accelerated modality of developmental math in a Florida state college in the 2015-2016 academic year?
2. What are student perceptions of combined modalities of developmental math and accelerated modalities of developmental math in a Florida state college in the 2015-2016 academic year?

Definitions

Acceleration: When acceleration is applied to developmental education the intention is to reduce the amount of time students spend taking developmental courses and allow them to enroll immediately or more quickly into college-level courses (Venezia & Hughes, 2013).

Assessment: Any test administered to place a college student at an appropriate level of English, reading, or math.

Combination: When multiple courses are combined into a single course, that covers the content of both courses at an accelerated rate (Venezia & Hughes, 2013).

Compression: When a course has been shortened from its traditional length but still includes the same amount of material. Also can be the combination of multiple courses into a single, intensive course (Venezia & Hughes, 2013).

Developmental Courses: Non-credited courses designed to prepare students for college-level math and English.

Kolb Learning Style Inventory: Also known as the LSI, the Kolb Learning Style Inventory is an instrument consisting of 12 open-ended questions. Participants rank answers from 1 to 4 in the order they would finish the question, with 4 being their first choice down to 1 being their least favorable choice.

Modality: The format in which a course is offered.

Modularization: When a course is set up into different units or modules and students can learn the material at their own pace (Venezia & Hughes, 2013).

Senate Bill 1720: Florida bill that passed into law in July 2013 allowing public high school graduates not to have to take an assessment test for placement in English, reading, or math.

Simultaneous Enrollment: When a developmental course can be taken simultaneously with a college-level course in the same discipline; also known as corequisite courses (Venezia & Hughes, 2013).

State College: Any two-year institution in Florida that awards associate's degrees and offers technical training.

Summary

This chapter was designed to provide an overview of developmental education, Senate Bill 1720, and the lack of research on current reform of developmental education modalities. This chapter has introduced the problems associated with developmental education courses in state & community colleges, its significance, a theoretical framework for understanding the problem, definitions of key terms, and the research questions that were used to examine this problem. This research will examine the relationships that exist, if any, between Kolb's learning styles and academic achievement in compressed developmental math modalities.

The required changes to developmental education modalities presents a situation that students have experienced since 2013 in the state of Florida. Many students now have a choice in whether they should take developmental education courses or not. However, in Florida, if students do choose to take a developmental course, it will not be offered in a traditional modality.

Senate Bill 1720 has changed the mode in which developmental education is being offered. Developmental education must now be offered in modularized, compressed,

contextualized or simultaneous instruction, or as a gateway course in the state of Florida (1720-Education, 2013). Since developmental education became more relevant in the 1960s and 1970s students had been taking developmental education courses over a full semester. However, student in Florida now must take the course in one of the new emerging modalities.

Kolb's (1984) theory of experiential learning provided the framework for this study. The LSI was administered to see if learning styles show a relationship with academic achievement in developmental courses based on the modality of the course. Furthermore, the types of learners students are may be reflective of how they perform in their developmental courses.

CHAPTER TWO: LITERATURE REVIEW

Background

At least half of all students who enroll at community college will need some kind of developmental education (Bailey et al., 2010). There have been many definitions for developmental education over the years, including learning assistance and remedial education (Arendale, 2010). Remedial education was a term for courses that were intended to help students who lacked skills needed to be successful in college-level courses (Arendale, 2010). However, the term developmental education describes learning assisted courses as ways to enhance the skills that students already have (Arendale, 2010). Many of the students who are enrolling in these courses are first generation in college, come from low socioeconomic backgrounds, are minority students, or are women (Crisp & Delgado, 2014; Doyle, 2012).

The success of these courses is widely debated amongst scholars. While many scholars argue these courses can be beneficial (Attewell et al., 2006; Bettinger, Boatman, & Long, 2013; Doyle, 2012; McCabe, 2000), other scholars contend statistics clearly show developmental courses are not helping students graduate (Bailey et al., 2010; Crisp & Delgado, 2014). With research results explaining developmental education students are not graduating, a nationwide movement has begun to fundamentally change the way developmental education is taught (Complete College America, 2014). As many as 32 states have changed or adopted policies that are similar to the mission of the nonprofit group Complete College America.

Senate Bill 1720 passed into law in 2013 and was Florida's response to the growing call for changes for developmental education across America (1720-Education, 2013). Senate Bill 1720 allows any students who entered a Florida public high school in 2003 and graduated from a Florida public high school in 2007 or later to enter college without having to take a mandatory assessment test (1720-Education, 2013). Active military duty students will also be allowed to bypass assessment testing.

In addition to removing required assessment for students, Senate Bill 1720 also made mandatory changes to the instruction of developmental reading, writing, and math courses (1720-Education, 2013). The state of Florida now requires colleges to offer developmental courses in one of five modalities of instruction. These modalities include modularized instruction; compressed, contextualized, or simultaneous instruction; or direct enrollment into a gateway course. Modularized instruction acts as a traditional length course over a semester but is broken into units or modules so that the students can work at their own pace (Venezia & Hughes, 2013). Compressed developmental courses are shortened from their traditional length into a shortened version while still offering the same course content. Additionally, compressed courses can also combine multiple developmental courses into a single course that covers material from both courses. Contextualized instruction integrates experiential learning into the course (1720-Education, 2013). Simultaneous instruction is also known as corequisite courses (Venezia & Hughes, 2013). These courses offer developmental courses alongside a college credit course simultaneously.

When students enter college-level courses and are not college ready, course instruction has to be altered in order to compensate for underprepared students (Perin, 2006).

Developmental education has been instrumental in upholding standards and quality for colleges and their students (Gabbard & Mupinga, 2013). In the past, colleges administered assessment testing to determine whether students were college ready or not (Camara, 2014). With the many changes coming nationwide to developmental education, scholars must continue to explore what does and does not work regarding the differing modalities of developmental education (Venezia & Hughes, 2013).

Community and State College History

William Rainey Harper was a leader in the foundation of the American community college (Drury, 2003). Harper was the president of the University of Chicago in 1892 and began to consider separating the first two years from the second two years of a bachelors degree at the University of Chicago. Harper felt that the first two years of many bachelor degrees were similar at his institution. He and other higher education leaders separated out the first two years of a degree and began to offer them at nearby high schools. Once students finished these two years, they were awarded associate's degrees, leading to the very first junior college in America, known today as Joliet Community College (Drury, 2003).

From 1960-1990, schools around the nation were experiencing growth especially community colleges (Cohen, Brawer, & Kisker, 2013). Societal problems including racial issues, educating society, and unemployment rates were expected to be solved by community colleges (Cohen et al, 2013). However, most of these problems were beyond fixing. Furthermore, government also expected these colleges to solve much bigger problems like

addiction, teenage pregnancy, and other issues through education. However, these were not the missions of the colleges (Cohen et al., 2013).

Community College Mission and Purpose

According to Dougherty (1994), the community college serves an important role in America. However, there are still questions surrounding what the purpose of community college should be. Some wonder if community colleges should focus on preparation for universities, vocational training, or adult education. While these have always been focuses of the community college, the community college is too complicated to point to single factor as its main purpose (Dougherty, 1994). Moreover, the community college may serve all facets of university preparedness, vocational training, and adult education depending on what is most needed at the time for the surrounding community.

James L. Wattenbarger was the first to start the community college system in Florida (Holcombe, 2006). His goal was for every Floridian to be within driving distance of a college. In 1957, Wattenbarger developed a plan to have community colleges or two-year colleges in a statewide system; this plan was completed in 1972 (Holcombe, 2006). In the 1980s, community colleges began implementing the open access mission that most community colleges are known for today.

The original purpose of the open access mission was to build educational partnerships in the community surrounding the institution (Holcombe, 2006). Building these relationships helped the colleges to grow quickly and develop curriculum without government interference (Holcombe, 2006). By the early 1980s, Florida community colleges saw their largest

enrollment numbers ever. At the time, half of their students were enrolled into transfer degrees (Holcombe, 2006). While many students hoped to transfer to four-year institutions, there were problems with articulation agreements.

Funding and Growth

One of the biggest sources of funding for Florida's first community colleges was the lottery system (Holcombe, 2006). Money generated through the lottery helped fund the colleges. The impact of the lottery system was so great that the community college revenues increased by 42% from 1983 to 1987 with this establishment (Holcombe, 2006). These revenues led to major growth for community colleges in the 1990s. In Florida, community colleges serve as one of the best ways for students to access a four-year university (Holcombe, 2006). Community colleges offer articulation agreements with four-year universities that guarantee acceptance, along with technical degrees that offer trainings in multiple disciplines. (Holcombe, 2006).

The Truman Report of 1947 also helped to develop the Florida community college system because it served as a large source of funding (Albertson & Wattenberg, 1998). The reason the community colleges received this funding was an attempt at increasing growth in the state of Florida. The creation and development of Florida's community colleges provided access to education that many had not received before. Many could not attend a postsecondary institution before because of financial reasons, geographical reasons, and lack of diversity in offered programs (Albertson & Wattenberg, 1998).

Change can be difficult for most organizations. Community college leaders must be able to lead change with Senate Bill 1720 going into effect. However, Senate Bill 1720 would not be the first time leaders of community colleges would have to adapt to change. Because community colleges are public institutions, they rely heavily on public funding; however, public funds have been decreasing steadily for community colleges forcing leaders to make changes in order to keep community colleges an affordable option (Jones-Kavalier & Roueche, 2010). Developing partnerships, building ladders of success, and transforming cultures are three ways community college leaders can guide their institutions through major changes (Jones-Kavalier & Roueche, 2010).

Enrollments also serve as a large source of funding for community colleges (Martin & Samels, 2009). Research has shown that when the economy is struggling, community college enrollments will usually increase (Betts & McFarland, 1995). In fact, community college enrollment rose by a half of a percent when the unemployment rate of recent high school graduates increased by 1% (Betts & McFarland, 1995). These enrollment numbers were based on full-time enrolled students. Similar numbers were seen in part-time enrolled students when the economy decreased.

When unemployment rates are high, people will pursue a postsecondary education to become more marketable to employers. Community colleges offer an open access mission, allowing anyone who attains a high school diploma or equivalent an opportunity for a postsecondary education (Betts & McFarland, 1995). Additionally, community colleges are more affordable than four-year institutions. With people unemployed and without the

resources to pay for an education at the university, community colleges often offer the best choice for them (Betts & McFarland, 1995).

Community colleges often have very tight budgets if they are publicly funded institutions, influencing policy decisions (Romano, 2012). Decisions made at community colleges are often determined by what the institutions' finances allow them to do (Romano, 2012). Furthermore, these problems could force policy decisions that would not normally happen (Romano, 2012).

Community Partnerships

Community partnerships are significant in getting students prepared for a college education. Community colleges often forge alliances with the community to create partnerships (Attewell et al., 2006). In addition to partnering with the community, technical colleges also provide skills that can help students develop and be college-ready. Community relationships also help students believe that college is attainable (Dew, 2012).

Guilford Community College (GCC) in Jamestown, North Carolina, has been able to create a partnership with a local area public school. What GCC has developed is a counselor position within the public high school to help students start creating academic plans for college (Jones-Kavalier & Roueche, 2010). The success of the program has led to an expansion into other high schools and even middle schools. Donald Cameron, an administrator with GCC, developed this program and believes that in order for both the college system and public school system to better prepare students for college more programs like this need to be created (Jones-Kavalier & Roueche, 2010).

El Paso Community College has shown success in leading its college through major change. President Richard Rhodes developed the “Ladders to Success” program, which has transformed the success of the institution (Jones-Kavalier & Roueche, 2010). Before Rhodes’s arrival, El Paso Community College was challenged with creating access for students, along with many students’ being underprepared in math. Ninety-seven percent of students who entered El Paso Community College entered a developmental math course. Rhodes helped to forge partnerships with community leaders and came up with ideas to create better access to higher education while also getting students to be successful in college. *Ladders* stands for “Lead with passion, Access, Develop the Team, Develop the Community, Evaluate, Respect legacy, culture and resolve to make a difference, and Strategic partnerships” (Jones-Kavalier & Roueche, 2010, p. 35). Since the implementation of this program at El Paso Community College, there have been increases in student retention and happier employees who have enjoyed assisting their students be successful (Jones-Kavalier & Roueche, 2010).

Lastly, culture is an important part of a successful community college. At Richland College in Dallas, President Stephen Mittlestet is embracing college and campus culture. Mittlestet has created 10 core values to create an engaging culture of innovation. These 10 values are “integrity, mutual trust, wholeness, fairness, considerate and meaningful communications, mindfulness, cooperation, diversity, responsible risk-taking, and joy” (Jones-Kavalier & Roueche, 2010, p. 36). In Mittlestet’s vision, he believes in order to provide students with a successful and positive culture, he must first create the same culture for the staff of the college. If employees of the community college are proud of their work

and enjoy it, students will inevitably become part of the culture and be successful (Jones-Kavalier & Roueche, 2010).

College Readiness

In colleges and universities today, assessment testing is administered to determine college and career readiness (Venezia & Jaeger, 2013). These tests only measure students' academic ability and do not factor in outside obstacles. Some scholars suggest that assessments need to be reevaluated to measure other variables (Camara, 2014). Many cognitive and non-cognitive factors can play significant roles in students' success in college (Komarraju et al., 2013).

The discussion of underprepared students in America began during the Reagan administration when Ronald Reagan wanted to improve postsecondary institutions (Barnes, Slate, & Rojas-LeBouef, 2010). During this time, the terms *college ready* and *academic preparedness* were said in the same breath. However, the terms are very different. Assessment testing can explain if a student is academically prepared, but it does not explain if a student is college-ready (Barnes et al, 2010). Colleges and high schools must work together to better align what is needed for a student to be college-ready (Barnes et al., 2010).

Non-cognitive factors can include self-concept, self-appraisal, the existence of external supports, and experience with leadership (Sommerfield, 2011). Assessment testing has been a poor predictor of college success in the past (Komarraju et al., 2013). Furthermore, high school GPA has shown stronger correlations to students' having success in college when compared to assessment testing (Komarraju et al., 2013). With so many

students entering college underprepared, understanding student deficiencies and when they occur is very important (Othman, Hamid, Budin, & Rajab, 2011).

Some high schools are applying academic assistance programs that examine students' college readiness at different points in high school (Othman et al., 2011). If students demonstrated any deficient areas, the assistance program provides support to develop the student further to ensure he or she is college-ready (Othman et al., 2011). In addition to measuring academic abilities, the assistance program accounts for non-cognitive factors that are also important in determining student success (Othman et al., 2011). Another program that has shown to help college readiness is dual enrollment (An, 2013).

Some research shows students who participate in dual enrollment programs have increased rates of student success. However, other research has shown that dual enrollment is unsuccessful (An, 2013; Venezia & Jaeger, 2013). In a study conducted by An (2011), students who were enrolled in a dual enrollment program had their GPAs rise by .11 GPA points (An, 2013). Dual enrollment has also shown to be successful for students with low high school GPAs. It is important for schools to market these programs so students are aware and can participate in them. (An, 2013).

Developmental Education History

Developmental education can be traced back to the start of democratization of American higher education in the 1800s (Arendale, 2010). According to Handel and Williams (2011), remediation can be traced to around 1840. During the mid-1800s, many policies and people played a large role in the democratization of American higher education

(Brubacher & Rudy, 1997). The Morrill Acts of 1862 and 1890 allowed more people to attend higher education institutions in America than ever before (Altbach, Gumport, Berdahl, & Geiger, 2005). These policies granted land to put a university in every state across the country and penalized any college that discriminated toward students in the admissions process (Brubacher & Rudy, 1997). With college accessible to more students, students entered college without the skills necessary to succeed. In order for these students to be successful, colleges created learning assistance programs to help their students (Arendale, 2010). These learning assistance programs were the first kind of developmental education in America.

In the 1600s, while there were no developmental courses or learning assistance programs, students did have tutors to help with any deficiencies (Arendale, 2010). In the early 1800s, precollege programs were created to help advance students skills before they enrolled into college (Arendale, 2010). From 1830-1870, the precollege learning programs transitioned to precollege learning academies, which were more similar to actual schools (Arendale, 2010). These schools helped students prepare for college just as the precollege programs did. In 1870, colleges started offering remedial courses for the first time at colleges (Arendale, 2010). While these courses were for students who were not college ready, they focused on students' deficiencies rather than on the skills they already had. These courses were offered all the way through the mid-1900s. From 1970-1990, colleges shifted from the term *remedial education* to the wording which these courses are now known by, *developmental education* (Arendale, 2010). Developmental education focused on the skills

that students already had in reading, writing, and math, helping them to prepare students for college-level courses (Arendale, 2010).

Developmental education has been traditionally offered at the community and state colleges in America, rather than universities (Roueche & Kirk, 1973). In the mid-1900s community colleges grew tremendously due to the creation of the Serviceman Readjustment Act of 1944 (Altbach et al., 2005). This Act allowed for returning service members of World War II to receive full funding for their college tuition (Altbach et al., 2005). Community colleges provided a place for returning veterans enroll in courses whether or not they had the skills that a traditional college student would have (Arendale, 2010). Community colleges have always offered an open access mission, and developmental education allowed students to be able to improve their skills and become college ready (Dougherty & Townsend, 2006).

The state of Georgia began its developmental education program in 1974 (Presley & Dodd, 2008). These programs were simple but successful. Students were assessed for college readiness based on the SAT (Presley & Dodd, 2008). However, as time went on, each academic institution developed its own assessment test for its students. In the fall of 1974, reports in the state of Georgia came out showing that developmental education courses were helping students with college-level coursework (Presley & Dodd, 2008). Furthermore, these programs were serving minority students more than any other demographic in the state of Georgia (Presley & Dodd, 2008).

Opponents of Developmental Education

Developmental education has statistically been unsuccessful (Crisp & Delgado, 2014). According to Bailey et al. (2010), the Achieving the Dream data set showed as few as 46% of students enrolled in reading developmental courses will actually finish their course sequence. Furthermore, only 33% of students enrolled in math developmental courses will finish their sequence of courses (Bailey et al., 2010). With success rates so low in developmental courses, legislators have questioned if it is worth spending the money that it costs to support these programs (McCabe, 2000).

In the 2007-2008 school year, it was estimated that developmental education cost students and colleges \$3.6 million (Bettinger et al., 2013). Other scholars have estimated the costs of developmental education at anywhere between \$1 billion and \$2 billion a year (Handel & Williams, 2011). Furthermore, the families of these students are incurring direct costs of up to \$700 million annually (Handel & Williams, 2011). Students are still required to pay tuition for these courses even though the courses are not credit bearing. Institutions must also fund these courses by paying for faculty and instructional support (Bettinger et al., 2013). Furthermore, if colleges and students are to endure the high costs for developmental education, opponents argue that the courses should be more successful in students retention and graduation (McCabe, 2000). Legislators argue if students are not successful in these courses, then the courses need to be reevaluated (Handel & Williams, 2011).

According to Crisp & Delgado (2006), only 35% of students enrolled in developmental education courses transferred to a four-year institution. Comparatively, 44% of students who started in college-level courses transferred to four-year institutions from the

same study (Crisp & Delgado, 2006). Poor success rates in developmental education has led to scrutiny of these courses (Daiek, Dixon, & Talbert, 2012). There needs to be more support provided to students who start college in developmental education rather than just teaching information that they should have learned in high school (Daiek et al., 2012).

Students who start college in developmental courses do not finish because the sequence of courses can be too time consuming (Bailey et al., 2010). Developmental courses are usually noncredit courses and if students have multiple developmental courses, they often can get disheartened and stop out (Bailey et al., 2010). Additionally, students enrolled in long sequences of developmental education are less likely to complete their two-year degree in less than three years (Complete College America, 2014). This poor performance led many states to change the way they support developmental coursework.

When students spend a long time in a developmental course sequence, it can lower the students' self-efficacy (Chambers Cantrell et al., 2013). Students enrolled in first year English Composition were more likely to have positive attitudes toward their courses (Chambers Cantrell et al., 2013). Furthermore, students not only experienced negative self-efficacy regarding their academic experiences when enrolled in developmental courses, but they also experienced negative personal experiences as well (Chambers Cantrell et al., 2013).

Proponents of Developmental Education

According to Doyle (2012), "eliminating remediation because many students don't succeed is similar to not performing CPR because so few people are successfully revived" (p. 63). Opponents of developmental education point to statistics of students' not succeeding or

transferring on to four-year institutions. However, many scholars have found that developmental education can be beneficial for students. While the successes of developmental education are not fully understood, without developmental education it is more likely that students will stop out of college (Bettinger & Long, 2009).

While some research shows students are not successful in developmental courses, there has also been research to support developmental education. One study conducted examined multiple high school mathematics students and their enrollment in developmental mathematics compared to college-level mathematics (Harwell, Dupuis, Post, Medhanie, & LeBeau, 2014). Some students started directly in college-level mathematics courses while others took developmental math courses. The researchers found that the students who were successful in the developmental mathematics courses were just as likely to go on and be successful in college algebra and calculus as the students who went directly into these courses (Harwell et al., 2014). This research supports developmental education and its positive impact on students.

Roueche and Kirk (1973) gathered data from community colleges across Texas and found that students of the same academic ability enrolled in developmental coursework were more likely to succeed in college than students who went directly into college level coursework. It is suggested that developmental education courses can be successful if they consistently evaluated and improved (Roueche & Kirk, 1973). Lastly, when faculty are invested in these courses students will show more success (Roueche & Kirk, 1973).

Developmental education includes a wide variety of students. Furthermore, many students enrolled in developmental education are minority students, women, or people from

low socioeconomic backgrounds (Attewell et al., 2006; Crisp & Delgado, 2014; McCabe, 2000). Developmental education programs are important because these populations are currently the least represented in American higher education (McCabe, 2000). Furthermore, proponents of developmental education believe that research should not compare students enrolled in developmental education to students who are enrolled in college-level courses because they have different socioeconomic backgrounds and academic abilities (Bettinger et al., 2009; Doyle, 2012).

Students of all backgrounds and abilities tend to struggle in the transitional phases in college (McCabe, 2000). Opponents of developmental education reference that students enrolled in developmental education courses are less likely to transition or be successful at the transitional phase than students from college-level courses. A comparative study was conducted with third graders enrolled in remedial programs and how they transitioned (Jacob & Lefgren, 2004). In the summer, third grade students took developmental education programs to develop skills they would need in higher level courses. The students came from low-income backgrounds and underachieved in school (Jacob & Lefgren, 2004). However, the results from the developmental program showed that the students were more successful moving into the next grade when taking part in a developmental program (Jacob & Lefgren, 2004).

Another population affected by changes to developmental education is adult learners (Goodman & King-Simms, 2005). States need to examine policies and efforts regarding remedial education and other support programs to ensure best practices are in place (Goodman & King-Simms, 2005). The state of Kentucky reexamined its policies regarding

how adult learners are treated and if they are benefiting from the remedial programs in place. After examining the policies, Kentucky reformed its entire remediation program and has seen positive results (Goodman & King-Simms, 2005).

Developmental education programs have been changing over the past two years due to the work created by Complete College America (Complete College America, 2014). There has been a push to change the format in which the courses are offered. Rather than other full-term, semester-based courses, there have been suggestions that courses offered in hybrid and compressed modalities could be more successful for students (Complete College America, 2014). These formats are all required by Senate Bill 1720 in Florida.

Multiple programs have been created to change developmental education and have shown positive results (Jaggers et al., 2015). The Community College of Denver, Cabot College, and the Community College of Baltimore created programs designed to accelerate either their developmental math or English programs (Jaggers et al., 2015). All three programs were more successful in transitioning students through the developmental courses than traditional developmental courses were. However, while students who enrolled in the accelerated English courses went on to be more successful in college-level English courses, the students enrolled in the accelerated math courses were not any more successful in college-level math courses (Jaggers et al., 2015).

In order to improve developmental education, it is suggested that there must be more research done on the topic (Handel & Williams, 2011). Furthermore, best practices that are working need to be researched so they can be improved and implemented at institutions that are not having success with developmental education (Handel & Williams, 2011). Student

strengths and weaknesses need to be measured and the courses need to develop around these strengths and weaknesses (Handel & Williams, 2011). Lastly, students academic abilities must be measured at earlier points in high school. If students experience interventions at an earlier point like high school, they stand a better chance to improve their grades and successes in class (Othman et al., 2011).

Senate Bill 1720

The governor of Florida, Rick Scott, signed Senate Bill 1720 into law in July 2013 (1720-Education, 2013). This bill made it a requirement for all Florida institutions to forgo any mandatory entry assessment testing for any Florida public high school graduate who started as a freshman in 2003 and graduated in 2007 or later (1720-Education, 2013). This bill also requires that active duty military are not required to take any kind of assessment testing. Furthermore, Senate Bill 1720 requires colleges within the FCS to alter the way they offer developmental education (1720-Education, 2013). These colleges must now offer the courses in multiple modalities and cannot offer them in a traditional format.

According to Complete College America (2014), students who are able to enroll in college-level courses quicker have a greater rate of success. From 2001-2007, the college system of New York offered accelerated developmental courses to their students to see if they would perform any better. Students performed well in the developmental courses; however, the long-term outcomes of the students were negative (Hodara & Jaggars, 2014). While long-term outcomes were negative, the accelerated developmental courses were more likely to get a student to enroll into a college-level English course by 9.7% when compared

to a regular developmental course (Hodara & Jagers, 2014). A negative result that was found in the program was that it was not as successful for math as it was for English. Students struggled when taking accelerated developmental math courses (Hodara & Jagers, 2014).

Another new type of developmental course suggested by Senate Bill 1720 is the combined course, also known as a learning community (Grubb, 2012). Learning communities have been shown to have great success when applied to developmental education courses (Grubb, 2012). These courses usually combine a developmental course with a college-level course in the same discipline and students will be enrolled in the two courses together (Grubb, 2012). However, like all of the other programs associated with developmental education there are still problems. One problem is that community colleges do not offer many learning community type courses because they can be costly (Grubb, 2012). Additionally, while students are successful in these courses, they still tend to struggle during the transitional phases of college.

Dissertation research conducted by Cruz-Johnson (2012) found that the results of blended courses on student success were mixed for developmental courses. Blended courses are courses that are partially online and partially face-to-face. These courses are also called hybrid. Overall success in these courses were not significant when compared to traditional developmental education courses. However, when student persistence was studied, the blended developmental courses were shown to have a greater impact (Cruz-Johnson, 2012). Students also perceived that the blended format was superior when learning the course material (Cruz-Johnson, 2012). Overall, the courses suggested by Complete College America

and required by Senate Bill 1720 have shown to be successful at times, but more research needed.

Compressed Developmental Education

As far back as the 1970s, students have had their frustrations with developmental courses and felt that advancing or accelerating these courses could help students be successful (Hampton, 1979). Students complain about the amount of time it can take to complete a developmental course sequence. Furthermore, believe the time spent in developmental education course is not valuable and often will stop out before enrolling into a college-level course (Bailey et al., 2010). Currently, 32 states in America have made changes to the way their state colleges offer developmental education, with some states eliminating it completely (Complete College America, 2014).

According to Radford, Pearson, Ho, Chambers, and Ferlazzo (2012), intervention is needed in developmental education because students have not shown success at persisting in traditional developmental education courses. Many students never make it to college-level courses because the sequence of developmental courses can be too long. Some early intervention programs that have shown some signs of success for developmental courses include supplemental instruction, compression, modularizing courses, and adding student success courses (Radford et al., 2012). Supplemental instruction provides tutoring and other support alongside a developmental course. Compressed courses have multiple modalities, including accelerated courses. Another compressed course modality is combined courses where multiple developmental courses are combined into a single course. Modularized

courses are courses that are broken down into units or modules that allow students to complete the courses at their own pace (Radford et al., 2012).

Accelerated Course Modalities

Accelerated courses are being promoted because of students' not being successful when taking multiple developmental courses (Hern, 2012). When students have multiple transitional phases it becomes harder to persist when the course does not count for credit (Hern, 2012). Accelerated courses have been shown to help with this problem (Hern, 2012).

Acceleration provides three ways for students to be successful in developmental course work (Venezia & Hughes, 2013). The first reason accelerating developmental courses can be successful is because it helps students avoid unnecessary developmental courses and allows enrollment in college-level courses faster. Secondly, courses are now aligned with college-level and technical courses to increase the rigor. Lastly, when developmental courses are accelerated, they usually will have some additional student support (Venezia & Hughes, 2013).

In New York, another study was conducted to examine the impact of accelerating developmental education courses and how that affects students (Hodara & Jaggars, 2014). The data collected for the study were taken from the CUNY system, which comprises 23 institutions, six of which are community colleges. From 2001-2007 students were placed into accelerated reading, writing, and math courses. Overall, the results were positive for students. Students who participated in an accelerated reading or writing course were 9.7% more likely to enroll in college-level English when compared to students who took traditional

developmental courses. Furthermore, those students were 6% more likely to complete the college-level English course. Over the course of the study, students who took accelerated English courses attained more credits and degrees than the students who took traditional developmental courses (Hodara & Jaggars, 2014). While these results were positive for English, the results were not as positive for math.

Students who participated in accelerated math programs did not show the level of success accelerated English students did (Hodara & Jaggars, 2014). However, while the students in math were not as successful as the students enrolled in accelerated English courses, their success rates did not decline. Overall the results from the CUNY system study showed positive results for students taking accelerated developmental education courses. Hodara & Jaggars (2014) believe the results from this study are positive for developmental education and could help enhance student retention and graduation.

Sheldon and Durdella (2010) conducted a study on the success of accelerated developmental courses when compared to traditional length developmental courses. The hypothesis for the study was that there would be no statistical or practical significance for students who participated in a accelerated modality of reading, writing, or math. Students for the study were from a suburban community college, and all students were enrolled in at least one developmental education course. The results for this study showed positive results for accelerated developmental education courses. Students who took part in the 8-9 week accelerated developmental writing course were 87% more successful than the students who took part in the 15-16 week traditional course; those students were 57% successful (Sheldon & Durdella, 2010). Furthermore, for math, students in the 8-9 week course showed a success

rate of 65% compared to 51% for those who took the traditional length math course. Lastly, reading students were successful 77% of the time in the accelerated format compared to 66% of students taking the traditional length course (Sheldon & Durdella, 2010). According to Sheldon and Durdella, “the results of this study clearly demonstrate that for students enrolled at this particular community college, developmental course length is associated with statistically and practically significant differences in course success in developmental education courses and these differences are consistently observed across all categories of age, gender, and ethnicity” (p. 52).

Another study examined what faculty perceptions were of teaching accelerated courses and how they affected students’ learning (Johnson, 2009). Eighteen faculty members were interviewed between one to two hours to gain their perceptions on teaching accelerated courses. The majority of these faculty members enjoyed teaching accelerated courses and believed that the courses did not diminish academic quality. The faculty also believed they had better attendance from students in the courses because students knew if they were to miss a class, it would be more detrimental than in a traditional course. With the courses’ being faster paced, faculty believed that students did not become fatigued that is often seen across traditional length courses. Most faculty members believed that student interest would decline if the length of the course was longer. While most of the faculty members spoke positively of the accelerated courses, some believed they did not have enough time to prepare for the courses. Overall, the perceptions of accelerated courses were positive from faculty in terms of teaching the course and the quality of the course for the students (Johnson, 2009).

Johnson and Rose (2015) examined faculty perceptions of accelerated courses at a university and two major themes arose. These themes were innovation in teaching and a sense of professional isolation. Participants of this study included faculty who taught in multiple disciplines and taught at least five traditional courses and five accelerated courses. Teaching accelerated courses, changed the perceptions of faculty members, including the overall way they felt about a quality education. Faculty also had a positive experience in teaching students in accelerated courses and observing their progression through the course. They also developed new innovative teaching methods that were designed for an accelerated course (Johnson & Rose, 2015). However, not all of the faculty experiences were positive.

Professional isolation is another theme that faculty who teach accelerated courses experience (Johnson & Rose, 2015). Some faculty who taught accelerated courses were isolated by other faculty because they did not believe in the teaching methods of the courses. The faculty members who were teaching the accelerated courses had the same beliefs before they began to teach accelerated courses. Furthermore, there was a sense of isolation from campus culture because the accelerated courses were offered during times when the campus was not populated. Ultimately, faculty felt somewhat split because while they felt secluded for teaching accelerated courses, they were still participating in meetings that were centered around their traditional course offerings (Johnson & Rose, 2015).

A population that has struggled with accelerated courses, specifically writing courses, is English as a second language (ESL) students (Scordaras, 2009). In a qualitative study, two case studies were developed to show the struggles that ESL students experience in accelerated writing courses. The first student in the case study was Anya from Uzbekistan.

Anya was shown to have multiple writing deficiencies in English but still opted to take the accelerated course. She was not educated on the difficulties of these courses and ended up not meeting two of the three requirements to pass the course. The second student was a Haitian immigrant named Pascal. He, like Anya, was not well prepared in English writing before enrolling into an accelerated writing course. When taking the accelerated course, Pascal fell behind quickly and, because of his lack of writing skills, was unable to catch up (Scordaras, 2009). He eventually failed the course.

While accelerated courses are not specifically designed for ESL, in this study, there were barriers and a lack of educational tools to explain the rigors to the students (Scordaras, 2009). Many times ESL students find accelerated courses beneficial because they want a faster way to complete courses. These courses oftentimes require students to work on multiple assignments at once, which can be problematic for ESL students because they can have struggles learning multiples concepts. ESL students are often poor at editing and revision as well. Oftentimes, these students need multiple attempts at revision and the accelerated courses do not allow enough time to complete the work. Scordaras (2009) recommends that ESL students in an accelerated writing course be offered additional time after the course.

Hern (2012) argues that students' having more exit points from course to course can create more opportunities for them to stop out and leave college. With students' sometimes having to take as many as three developmental education courses, this leaves more time for them to stop out (Hern, 2012). Hern provides three recommendations for developmental education reform. Those include shortening developmental education sequences so that

students are able to enroll in college-level courses faster. Secondly, institutions must not place so much emphasis on college assessment tests as placeholders for students' academic success. Lastly, developmental education should be streamlined and include intentional support from multiple areas. While reform is needed, Hern (2012) does not feel that developmental education courses should be eliminated.

Combined Course Modalities

Developmental education is typically offered in reading, writing, and math. Many compression programs for developmental education have been successful in all three areas; however, reading and writing have shown the most success (Venezia & Hughes, 2013). According to Cafarella (2014), compressed math courses can be successful, but success requires students and faculty members who are prepared the courses. For her study, 20 faculty members were interviewed regarding the different math modalities offered at Sinclair Community College in Dayton, Ohio. The three modalities of developmental math that are offered at Sinclair Community College are online, combined, and traditional. Faculty felt that the students who were successful in the combined modality also showed good time management and were also competent with technology (Cafarella, 2014).

Another combined program for math is the Path2Stats program in California (Hern & Snell, 2014). Los Medanos College in California examined that students were not successful in developmental courses because the students who were being placed into these courses were being singled out and discouraged. They believed that if students enrolled into college-level courses quicker then there would be a chance that they could have better success. In

2009, the institution created the Path2Stats program, which allowed students a quicker path to enrollment in college-level statistics. Students would take a one-semester, combined, introductory level statistics course without taking a placement test. After finishing this course, students would move directly into college-level statistics. The results from this program were very positive. Students who participated in the Path2Stats program were three times more likely to complete the college-level statistics course than students who got into the statistics course by way of a traditional developmental education sequence (Hern & Snell, 2014).

The Community College of Baltimore is another community college experimenting with compressing developmental education. This institution observed that success rates in its developmental writing courses had not been increasing since the late 1980s (Adams, Gearhart, Miller, & Roberts, 2009). Of the students taking the developmental writing courses, many never made it into Composition I and thus did not move forward to graduate. The Accelerated Learning Program (ALP) was created in the spring of 2007 to get students through developmental writing into college-level English. This program was available to students who volunteered for it. The modality of this program followed the combined method of compression by combining college-level courses and developmental courses. These courses were lengthier in time and were taught by the same instructor. This modality was offered to students who needed developmental courses and to students who placed directly into college-level English as well. The students who were college-ready did not have to take the supplemental writing course. Of the nearly 240 students who participated in this program, 63% of the students went on to pass college level English (Adams et al., 2009). Furthermore,

students who participated in the ALP were 28% more likely to complete college-level English than students who did not participate in the ALP program (Jaggars et al., 2015).

The ALP program at the Community College of Baltimore worked because it removed the stigma of developmental courses by allowing these students directly into college-level courses (Adams et al., 2009). Additionally, these courses created learning communities by placing students who needed additional help alongside students who placed directly into college-level courses. Adams, Gearhart, Miller, & Roberts (2009) further state that this program saves the community college money because more students were successful in the courses; therefore, the college did not have to offer as many sections. Ultimately the ALP program at the Community College of Baltimore doubled the success rates of students and cut attrition rates in half (Adams et al., 2009).

Other colleges that have implemented accelerated developmental education programs across the country include the Community College of Denver and Chabot College (Jaggars et al., 2015). At the Community College of Denver, a program known as FastStart was developed. This program combined multiple developmental courses with college level courses (Jaggars et al., 2015; Venezia & Hughes, 2015). Over three years, the students who participated in the FastStart program were 11% more likely to complete college-level math (Jaggars et al., 2015). While the FastStart program was seen as successful, students did not accrue as much college credit as the students who participated in Chabot College's accelerated program (Jaggars et al., 2015). According to Jaggars, Hodara, Cho, and Xu (2015), "At Chabot, the accelerated sequence eliminated an entire developmental course, allowing students to fit an additional college-level course into their schedule" (p. 17).

At Chabot College, traditional developmental courses were combined into a single developmental course to be taken over the course of one semester, also known as combined enrollment (Jaggars et al., 2015). The students who participated in combined developmental courses were 17% more likely to complete college English. Jaggars, Hodara, Cho, & Xu's (2015) study showed that combined developmental education can show success in both math and English. Even for students who performed poorly on college placement tests, positive results were seen when they took combined developmental education (Jaggars et al., 2015).

Course Modalities

As a result of Senate Bill 1720, multiple course designs have been developed in hopes of increasing student success. A traditional course at a college or university is often offered for three-credits across 16 weeks of a semester. However, now courses are offered fully online, partially online, compressed, supplemental instruction or simultaneous enrollment with others. Many researchers are studying the impact these different course modalities have on student success.

Results of studies on supplemental instruction have been positive regarding improving student success in developmental education (Moore & LeDee, 2006). Students who would possibly be D or F students would typically earn Cs with supplemental instruction (Moore & LeDee, 2006). While improvements were not drastic, the results were still positive.

Web-based courses can be offered either completely online or in some type of hybrid format. In a study conducted in France, researchers examined students enrolled in two

separate modalities of web-based courses. Researchers studied academic success of students who enrolled in blended or fully online modalities (Fenouillet & Kaplan, 2009). The two disciplines that students were enrolled in were educational sciences and art history. Students' final grades were collected as a determinate of academic success. In total, 682 students were sampled and surveyed regarding the courses they completed. Overall, students who completed their courses online did not have as high of a success rate as students who completed their courses in either a blended format or face to face. However, students in education sciences courses did show success in online and hybrid courses. When comparing the two disciplines, art history students did not perform as well in the online and blended courses as did the education science students (Fenouillet & Kaplan, 2009).

Another study examining blended, or hybrid, courses broke a course into three different methods in order to determine sense of community (Harrison & West, 2014). The course in the study was a technology integration course that was one credit hour. The first of the three methods had open labs, open workshops, and a more structured schedule to increase the sense of community. The second methods tested more prescribed instructor feedback with assignments, and method three had no instructor feedback. Students who enrolled in the course came in at different abilities of technological competence and could have been enrolled the course at any time in their academic careers (Harrison & West, 2014).

For the first method, there were challenges with the face-to-face portion because the course was only one credit hour (Harrison & West, 2014). The measure of sense of community actually decreased for the first method. The second method intentionally created more interaction between the faculty member and students by requiring structured feedback

from faculty to students. Additionally, faculty made sure to address students by name when talking to them. This method showed a slight increase in sense of community from method one. Method three did not have any set interventions to increase sense of community. There was a decrease from method two to method three when measuring the sense of community (Harrison & West, 2014).

Overall, blended courses are shown to be a more flexible option for both students and faculty (Harrison & West, 2014). In fact, students' overall ratings for methods one and two were positive, while method three showed a significant decrease in student ratings. The results of this study also demonstrated that while sense of community can decrease in a blended format, if there is instructor interaction built into the course, it is possible to create a more positive sense of community (Harrison & West, 2014).

In addition to blended courses, distance learning, or online courses, is another type of course modality that is used in colleges and universities today. At the University of Alaska, distance learning is delivered to their farming programs, and multiple software platforms are integrated to assist students learning the material (Rader & Gannon, 2015). The most common technologies delivered were Blackboard, teleconferences, and a program called Elive. Students preferred Elive because it allowed them to communicate more efficiently with other classmates. Ultimately, students were satisfied having multiple platforms in which they could access the courses (Rader & Gannon, 2015).

Another type of online course is a MOOC. A MOOC is a massive open online course (Rubens, 2014). MOOCs have often been criticized for their pedagogies because they are not effective in measuring student learning. However, applying the pedagogical design on

distance education for adult learners, there have been positive results seen from students in MOOCs. Ruben's (2014) research teams broke into three separate groups. The first group was responsible for the technological development of the course. The second team was responsible for the implementation of the adult education pedagogical design. The third team was responsible for the efficiency of the course. The courses were offered as online master's courses. Educational outcomes for students were measured as positive, and the results also demonstrated that the new design attracted many new students to enroll in online courses (Rubens, 2014). While these results were positive, there is still no standard for the course design of a MOOC.

Some faculty felt that accelerated courses, while more difficult, can be beneficial for students (Ferguson, Baker, & Burnett, 2015). In comparing traditional courses, dual enrollment courses, and accelerated courses through both syllabi and faculty interviews, it was shown that many faculty members feel that traditional courses are the least intensive course, even more so than dual enrollment. Of the three course modalities, the faculty felt that accelerated courses are the most rigorous and that students must come prepared if they expect to do well. Even dual enrollment faculty felt that their courses are more difficult than traditional courses. While these courses were believed to be more difficult, faculty also felt that students learned more in the accelerated courses (Ferguson et al., 2015).

Nontraditional students are a population that has been shown to have success with accelerated courses (Gershuny & Rainey, 2006). A sample was drawn from accelerated introductory business law courses at two separate universities. There were differences shown between traditional age students and nontraditional age students. One difference was the

amount of time students believed they needed to study. Traditional age students felt that they would need to devote only between one to two hours of study time for the course, while nontraditional students felt that study time outside of class should range between two and eight hours. When the courses were completed, nontraditional students compiled an average 3.51 GPA compared to the 3.17 GPA of the traditional age students. Despite having higher GPAs, the nontraditional students rated the faculty members lower than the traditional age students did (Gershuny & Rainey, 2006).

Learning Styles

The changes to developmental education modalities in Florida have come as a requirement from Senate Bill 1720. However, little research has been conducted explaining which types of learners are successful in these modalities. More evidence is needed from the students in these classrooms in order to gain more knowledge on the newly required modalities. This section will examine the literature on the history of learning styles, the different learning style models, Kolb's LSI, and how the Kolb LSI has been administered in different course modalities.

History of Learning Styles

The concept of learning styles comes from the theory that people have different preferences in processing information and thus can learn in different environments (Pashler, McDaniel, Rohrer, & Bjork, 2009). Researchers often administer tests or instruments to determine learning styles in their participants. One of the earliest models of these instruments is the Myers-Briggs assessment of personality types. This instrument was popular in the

1940s and is still popular today. However, the most popular learning instrument in current research is the Kolb LSI (Pashler et al., 2009).

The Kolb LSI categorizes learners into four categories (Kolb, 1984). These four categories are divergers, accommodators, assimilators, and convergers. The Kolb LSI began in the 1970s, with multiple updates to the instrument through the 1990s (Kolb & Kolb, 2005). Accommodators favor concrete experience and active experimentation. Divergers prefer learning using concrete experience and reflective observation. Assimilators prefer learning through reflective observation and abstract conceptualization. Lastly, convergers prefer to learn by abstract conceptualization and active experimentation. While Kolb's LSI a preferred instrument for research, the visual/auditory/kinesthetic (VAK) and the visual/auditory/read-write/kinesthetic (VARK) instruments are the most widely applied terms in the learning style taxonomy (Bishka, 2010).

The VAK and the VARK are instruments that have become popular in the educational setting (Cuevas, 2015). The VAK and the VARK instruments are related to participants' senses. This differs from many other learning style models, like Kolb, because senses are concrete concepts and are easier for people to understand and measure. Additionally, these instruments are administered in the educational setting because nearly all senses are applied in a classroom setting (Cuevas, 2015). Senses can be easily measured and correlated with learning in the classroom.

Since the concept of learning styles have been studied, they have been instrumental in educational research (Rohrer & Pashler, 2012). Most research seems to support that designing courses around student learning styles can benefit students. However, not all

research supports redesigning courses because of learning styles. Rohrer & Pashler (2012) contend research needs to be conducted administering VARK taxonomy to assess student learning and student achievement centered around the different learning types. Specifically, students who are visual learners and students who are verbal learners would be enrolled into classrooms that would support their learning styles. They contend two outcomes must occur in order to support learning styles as a method for redesigning classrooms. The first outcome would need explain that visual learners performed at a higher measurement in visual courses than verbal courses. Furthermore, verbal learners must perform at a higher measurement in verbal courses than visual courses. Rohrer and Pashler (2012) contend that much of the literature on learning styles do not provide these results.

DeBello (1990) compared 11 different instruments regarding learning styles, including the Kolb LSI. His research explained that educational institutions should integrate learning styles into the classrooms. However, educational systems must consider two ideas when administering learning style instruments in schools. The first is to ensure that redesigning an educational setting to fit a students learning style is supported by literature and secondly, is the understanding that redesigned classrooms may not benefit all students the same (DeBello, 1990).

Studies about learning styles with college students have added to the body of knowledge and have ultimately helped to understand the possible usage of learning styles. Green and Parker (1989) explored learning styles and how they related to students' college aptitude and knowledge of their majors. There were 147 participants in the study, and they also took the interest schedule instrument to determine their academic and vocational

attributes. The study found all four of Kolb's learning styles among the participants. Additionally, each learning style showed a relationship to students' ability to decide their academic majors. Additionally, there were strong correlations between students learning type and their ability to work in group settings (Green and Parker, 1989).

Ultimately, learning styles do not provide knowledge about students' ability but rather their preferences in learning (Willingham, Hughes, and Dobolyi, 2015). Two predictions can be made with learning styles. The first is someone's learning is constant, meaning that it should be the consistent across multiple situations. An example would be a visual learner; he or she will learn best through visual instruction, regardless of the material that is being taught. The second prediction regarding learning styles is that a person's cognition should be improved when learning in his or her preferred setting. An example would be an auditory learner remembering more material in a quiet setting (Willingham et al., 2015).

Learning Style Models

No matter the instrument, learning styles can be categorized into four models, including instructional preference methods, social interaction, information processing, and personality (Curry, 1983). The instructional preference methods refer to a learner's choice of environment in order to learn, such as a large classroom versus a small classroom. Social interaction examines a learner's preference for social situations. Information processing examines the learner's process for dissecting information as he or she receives it. Lastly,

personality is how a learner perceives what he or she is learning and how those experiences may change that perception (Curry, 1983).

Instructional Preference Models

The learning preferences of individuals can also be defined as their instructional preference. Environment can play a large role in the instructional atmosphere one must learn in. Environment is one of the areas that can have an effect on students' instructional preferences (Dunn & Dunn, 1978). The areas that make up an environment are temperature, sound, and light. Depending on the learners' preferences for each of these, the learners may have positive or negative learning experiences (Dunn & Dunn, 1978). The second area is the emotional preferences of learners (Dunn & Dunn, 1978). The traits found within emotional preferences are responsibility, structure, motivation, and persistence. The third area discussed is the sociological preferences of learners. The traits included are whether or not learners prefer groups or individualized learning. Lastly, psychological preferences are mentioned. Time, perception, and ability to move are the traits that define the psychological preferences (Dunn & Dunn, 1978). Dunn and Dunn's (1978) model closely mirrors Curry's.

More recently, senses have been seen as being the instructional preferences that define one learning style. One study collected data on students because the literature explained engineering course pedagogies show negative correlations with engineering students' learning preferences (Chowdhury, 2015). Mostly, engineering students are active, visual, inductive, and sensing learners. However, engineering courses have often been designed counter to these learning preferences. Engineering courses are often verbal,

inductive, and passive in instruction. Some researchers believe that because of this inconsistency between instruction and learning preferences, engineering students struggle (Chowdhury, 2015).

Chowdhury (2015) examined engineering students to confirm his claims. Surveys were administered to engineering students and engineering faculty to determine what their learning and teaching styles were. The Project Based Learning (PBL) style of teaching was being implemented for engineering students. This method favors facilitator-style instruction. Of the engineering students who participated in the PBL instruction, 57% were determined to be active learners, 71% were sensory, 83% were visual, and 69% were sequential. These percentages were vastly different from the instructors', who measured as being strong facilitators and delegators during their instruction. Of the students examined, only 22% indicated that they preferred to learn in a group setting. Chowdhury's (2015) research recommended there be vast improvements to PBL to match students' learning styles.

In another study measuring sensory learning styles, the VAK instrument was administered to determine medical students' learning styles and place them in instructional courses that were intentionally designed to meet their learning preferences (Anbarasi et al., 2015). Medical students come from diverse backgrounds and have different learning styles, yet they are all taught with the same methods and pedagogies. Of the medical students surveyed, 34 measured as visual learners, 44 measured as auditory, and 28 measured as kinesthetic. These students were intentionally enrolled in instructional courses that were designed based on the individuals' learning styles. Additionally, a fourth group of 40 students served as a control group, where students from all three learning styles were taught

in the traditional course. There was a statistically significant difference in all three groups when compared to the traditional learning group. This research emphasized the importance of matching instructional design to the preferred method of learning (Anbarasi et al., 2015).

In another study to match course designs to students' learning styles, research was conducted to redesign a course to fit the individual learning styles of ESL students (Kuo, Chu, & Huang, 2015). The students were surveyed to determine their learning styles. The Kolb LSI was administered. An online program was created once all on the participants learning styles were determined. Furthermore, a control group was studied to measure the differences in performance from the learning style-based course. Researchers found that students who enrolled the learning style-based online instructional courses were more successful than the students who were enrolled in the traditional ESL courses (Kuo et al., 2015).

Not all literature supports the idea of designing classrooms based on the individual learners' preferences. Rohrer and Pashler (2012) suggest that there is not enough evidence to support redesigning only from learner preference. Rogowsky, Calhoun, and Tallal (2015) recreated the study conducted by Rohrer and Pashler. They administered Dunn and Dunn's (1978) instrument to survey college aged students, specifically examining their preferred modes of instruction and their verbal comprehension aptitudes. Additionally, participants were surveyed to determine if they measured as auditory or visual learners. The research explained that there were not any statistically significant correlations between learning style and the comprehension of course material. Additionally, the results showed no statistically significant relationships between learning styles and the modalities learners received the

information from. In this research, the modalities examined were electronic books and regular texts for reading comprehension. Ultimately, this research does not support redesigning classroom to fit the learning styles of individuals (Rogowsky, Calhoun, & Tallal, 2015).

The literature on the topic of instructional preference models seems to be divided. Some researchers believe that if courses are designed from learning styles, they could improve the achievement of students (Anbarasi et al., 2015; Chowdhury, 2015; Kuo et al., 2015). However, other researchers' studies do not support the redesign of courses (Rogowsky et al., 2015; Rohrer & Pashler, 2012). These researchers do not believe there is enough evidence to support the change in course design. In order to develop more knowledge on the subject, more research is needed.

Social Interaction Models

Social interaction models examine the learning that occurs in different social environments. Some learners prefer to learn in groups, while others prefer to learn on their own. Multiple models have researched these dynamics. Additionally, multiple studies have administered the instruments of these models in order to determine what environments best apply to different types of learners. These models have been applied to different research studies examining the effects of social interactions and how they affect learning.

Fuhrman and Grasha (1983) explain that learning occurs in three different styles in a social context. These styles are dependent, collaborative, and independent. The dependent preference of learning is when learners have no prior knowledge of the subject matter.

Collaborative learning takes place when multiple people work together to solve a problem. Lastly, the independent preference for learning is when learners choose to learn material by themselves (Fuhrman & Grasha, 1983).

Another social interaction learning model is the model developed by Grasha and Reichmann. This model differs from other models because it assesses learners' behavior based on activity, rather than measuring their personalities (Grasha, 1996). Grasha and Reichmann divided their learning into six different styles. These styles are dependent, independent, avoidant, participant, collaborative, and competitive. Each of these styles is measured administering classroom activities. From these activities, three learning styles were developed. These were dependent-independent, avoidant-participant, and competitive-collaborative. These learning styles were created regarding the interactions that students, peers, and teachers had with one another (Grasha, 1996).

A more recent model on interaction theory is Anderson's interaction equivalency theory (2003). This model examines the interactions between students and teachers. There are three major types of interactions within this model. These interactions are student-teacher, student-content, and teacher-content. This model suggests that if these interactions are strong then the learning that occurs can be positive (Anderson, 2003).

In a study that administered the Grasha-Reichmann learning style scale, 62 engineering students were surveyed to determine their social interaction learning styles (Deveci, 2013). Pre-test and post-test results were collected and analyzed to determine how the participants interacted in groups. The results showed that the participants' scores increased for avoidant, participant, and collaborative. Additionally, the participants' scores

decreased in competitive and dependent. This led the researchers to suggest that more group work is needed in engineering courses (Deveci, 2013).

Personality Models

A popular personality assessment in research that studies learning is the Myers-Briggs Type Indicator (MBTI). The MBTI divides people's personalities into 16 categories, that are then divided into four personality types (Myers, Most, & McCaulley, 1985). Each group consists of two personality-scoring areas. These areas are introverted and extroverted, sensing and intuition, thinking and feeling, and lastly, judging and perceiving. People are scored in each area based on questioning from the instrument. People are assigned with a four-letter indicator of their personality types that reflect the different areas. While this is not a learning style test, it is often administered in studies having to do with learning (Myers et al., 1985).

Another popular instrument administered for assessing personality is the five-factor model (Digman, 1991). The five-factor model is administered mostly in psychological research. This model consists of dividing people's personalities into five areas. These areas consist of openness to experience, conscientiousness, extraversion, agreeableness, and neuroticism (Digman, 1991). While this assessment is mainly administered in psychological research, it has also been applied with learning theory.

Personality is a measure of people's learning styles (Komarraju, Karau, Schmeck, & Avdic, 2011). A recent study examined 308 undergraduate students and learning styles. Furthermore, the study measured how their personalities were related to their academic

achievement. The five-factor model was administered to measure students' personalities. Out of the five learning styles, two styles, conscientiousness and agreeableness, were positively correlated to all learning styles. Neuroticism showed a negative relationship with all learning styles. When all of the styles from the five-factor model were compared to participants' GPAs, they accounted for 14% of the variance. This research further supported the concept of designing classrooms around student learning styles, as well as students' personalities (Komarraju et al., 2011).

In another study examining personalities in an educational setting, the MBTI was administered to examine gifted students (Mills & Parker, 1998). Of the 1,246 students tested, a sample of 309 students was examined. According to Mills and Parker (1998), the majority of U.S. students are seen as pragmatic and fact-based thinkers. However, their study showed that gifted students were different and measured higher in intuition. This measurement suggests that gifted adolescents are different from the typical student. Furthermore, gifted students are more theoretical than pragmatic when thinking and learning (Mills & Parker, 1998).

The MBTI was administered in another study, comparing how people's personality types compare with their social learning types (Emerson, English, & McGoldrick, 2016). Students were placed into a group learning scenario and an independent learning scenario. Students of all personality types were examined across both learning scenarios. The group learning activities increased traits that might not necessarily be part of the students' personalities (Emerson et al., 2016).

Information Processing Models

Curry (1983) explains that information processing is the process by which information is gathered, stored, sorted, and utilized. One information processing model theory is Gardner's Theory of Multiple Intelligences. Gardner's theory explains that there are eight different intelligences utilized for information processing (Gardner & Hatch, 1989). These eight intelligence processes are defined by a learning term. The types of learners described in Gardner's theory are the linguistic learner, the logical/mathematical learner, the visual learner, the musical rhythmic learner, the bodily/kinesthetic learner, the interpersonal learner, the intrapersonal learner, and the naturalistic learner (Gardner, 1984).

The linguistic learner is a person who learns and processes information best when he or she is talking, listening, or visualizing information (Gardner, 1984). This learner processes information best when he or she reads or writes information down. Additionally, this learner is knowledgeable of language and words. Furthermore, the linguistic learner works well with independent learning.

The second intelligence process in Gardner's theory is the logical/mathematic learner (Gardner, 1984). This learner processes information best when he or she is tasked with categorizing or classifying information. These learners are also hands on and like working with tangible objects. These learners tend to be good with math and science.

The next intelligence type mentioned in Gardner's theory is the visual learner (Gardner, 1984). This person learns best by thinking and dreaming. He or she processes information by working with colors, creating, playing, and building. These people are best at

solving puzzles, reading maps, or building things. The traits of information processing work well for engineers, architects, and other construction based workers.

The musical or rhythmic learner is another information processing type in Gardner's theory (Gardner, 1984). This type of person learns best by melodies, beats, sounds, and music. Often times these learners like to learn music and play instruments. They often like to sing or whistle music that they have heard before.

The next learner is the bodily or kinesthetic learner. This learner processes information best when performing activities or anything that may be physical (Gardner, 1984). These learners are often athletes and are often involved with different sports. Additionally, the bodily learner may physically work out whatever information he or she needs to learn.

Gardner's (1984) next information processing type is the interpersonal learner. This learner works well in groups and often likes to collaborate and share ideas. These learners are often extraverted and like to be part of a team. These learners also prefer to absorb the environment in their leaning or processing of information. Lastly, these learners are good at creating working relationships.

Next, the intrapersonal learner is the opposite of the interpersonal learner, seeking to process information alone (Gardner, 1984). These learners prefer to work on their own, in their own space, and do not prefer working on projects in groups. These learners are often referred to as introverts. Rather than focusing on the outside environment, this learner prefers to think and reflect on his or her own environment.

Lastly, the naturalistic learner likes to process information by collecting, sorting, and categorizing (Gardner, 1984). These learners prefer to identify items and then categorize them. These learners work in various fields. Gardner's eight types of information processing provide a guide for the best situations or environments for a learner's preference (Gardner, 1984).

Kolb's Experiential Learning Theory

Kolb's experiential learning theory is a processing information model that is widely administered in research today. The Kolb Experiential Learning Theory describes how learners perceive and process knowledge through the experiences (Kolb, 1984). Experiential Learning Theory developed through Dewey, Lewin, and Piaget's research. Furthermore, Kolb (1984) created a self-assessment test that determined what type of learner an individual may be.

Kolb's (1984) theory presents a cyclical model of stages. These four stages for learning are concrete experience, reflective observation, abstract conceptualization, and active experimentation. As a learner is having an experience, they will complete each stage of learning. As the learner is experiencing a stage, they will perceive the information during the concrete experience stage and abstract conceptualization stage. Furthermore, the learner will process the information while completing the active experimentation and abstract conceptualization stages (Kolb, 1984).

As previously mentioned, each stage in Kolb's theory is cyclical. During a learning opportunity, learners progress from one stage to the next, as a result of processing an

experience. *Concrete experience* is defined by Kolb as learning that occurs in the physical or active participation during the experience. Following concrete experience in Kolb's model is reflective observation. *Reflective observation* is defined by Kolb as the visual transformation of the experience. The next stage in the model is abstract conceptualization. *Abstract conceptualization* is the cognitive perception of the experience. Lastly, *active experimentation* explains how a learner will apply the previous stages to when he or she will partake in the experience again through reflection.

Each stage is explained through either perceiving or processing information along two dimensions. Concrete experience and abstract conceptualization are both perceiving the experience that is occurring. During each stage, the learner is noticing, observing, and identifying what is taking place during the experience. Abstract conceptualization and reflective observation reflect when a learner is processing the information. During these stage the learner is making meaning of what is occurring.

Kolb (1984) explains that all people have a preference for the way in which they learn. Furthermore, Kolb's theory explains that everyone has a preference for how learners take in information and how they process information. Kolb labeled these learning preferences learning styles. The four learning styles mentioned are accommodators, divergers, convergers, and assimilators (Kolb, 1984).

Learners who show a preference towards active experimentation and concrete experience are considered accommodators (Kolb, 1984). Accommodators prefer working in group settings. These learners also show a preference in working with tangible items. Furthermore, accommodators will often take risks and act on their intuition. Rather than

being logical, accommodators will trust instinct. Accommodators work well in business related fields (Kolb, 1984).

A learner who shows a preference for active experimentation and reflective observation is a diverger (Kolb, 1984). Divergers prefer feeling and watching an experience occur. These learners are creative. Divergers are generally well liked by other people. They can also be sensitive to other feelings. These learners are often artist, humanitarians, or work in sociological fields (Kolb, 1984).

Learners who prefer reflective observation and abstract conceptualization are assimilators (Kolb, 1984). Assimilators are logical like accommodators. However, these learners do not work well in groups and prefer learning individually. They also enjoy applying theory when making decisions. Like divergers, assimilators also have great imaginations. Assimilators often work in science and research related fields (Kolb, 1984).

Lastly, those who show a preference for abstract conceptualization and active experimentation are convergers (Kolb, 1984). Convergers enjoy experimenting with different ideas. These learners are excellent problem solvers and enjoy pragmatism. They differ from divergers because they are practical rather than imaginative. Convergers often find their professions in science, technology, engineering, or math related fields (Kolb, 1984).

The Kolb Learning Style Inventory (LSI) was developed to measure a learners learning style. The instrument consists of 12 open-ended statements. Participants will rank the responses to the statements from 4 to 1, with 4 being the preferred choice. The scores are then added to determine the participant measures in each of the four learning stages. After scores are gathered for concrete experience, reflective observation, abstract

conceptualization, and active experimentation, the researcher subtracts the reflective observation score from the active experimentation score and subtracts the concrete experience score from the abstract conceptualization score. Lastly, the final two scores plotted onto the Learning-Style Type Grid to determine a participants learning style.

Figure 1 below represents Kolb’s experiential learning model. The four stages are described along the two dialectics. Between each stage, lines represent the cyclical progression of the learning. The vertical dialectic between concrete experience and abstract conceptualization represents the perception that occurs during the experience. The horizontal dialectic between reflective observation and active experimentation represents the processing of information occurring in the experience. Below Figure 1, Table 1 provides a summary of the attributes related to the different learning styles in Kolb’s model.

Adapted from Kolb (1984).

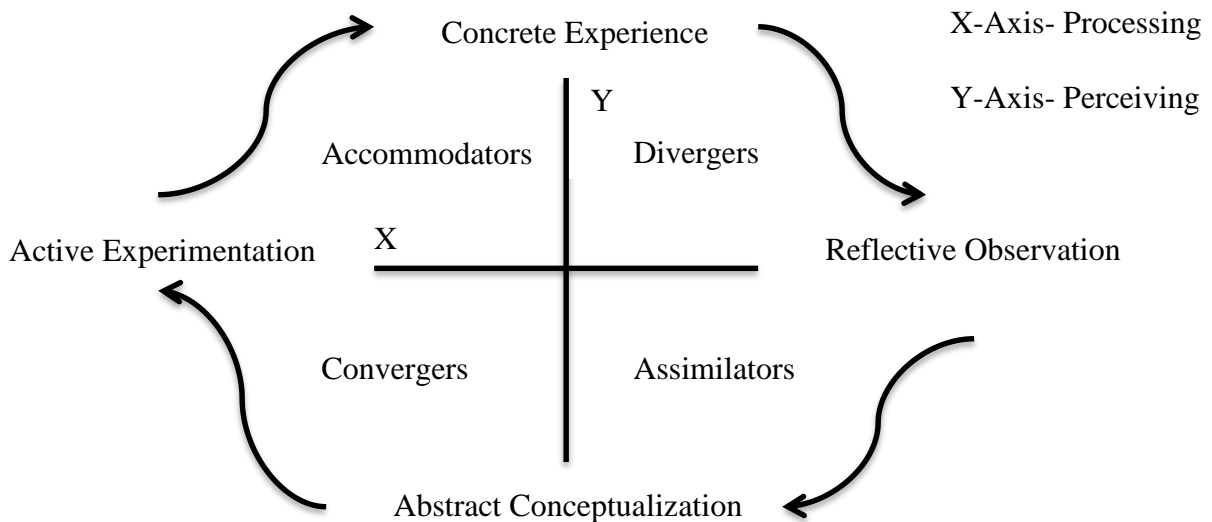


Figure 1. Kolb’s Experiential Learning Model.

Table 1: Kolb's Learning Styles (Kolb, 1984)

Accommodators	Divergers	Convergers	Assimilators
Learn hands-on	Prefer observing over doing	Excel at problem solving	Enjoy using theory to make logical conclusions
Prefer intuition over logic	Apply imagination	Prefer experimenting with ideas	Prefer individual learning
Enjoy working in a team setting	Are people persons	Enjoy practicality of ideas	Have great imaginations
Often take risks	Are sensitive to feelings	Work well in engineering and technology fields	Work well in science and research fields
Work well in a business field	Work well in arts and humanities fields		

Kolb's Experiential Learning and Course Modalities

Kolb's experiential learning model has been applied to frame research in the educational setting (Pashler et al., 2009). Furthermore, different course modalities have been examined by administer the Kolb LSI. This section explores research on course modalities that administered the Kolb LSI.

In a study conducted by Engleberg, Schwenk, and Gruppen (2001), medical students enrolled in an intensive four-week microbiology and infectious disease course were surveyed to determine their learning styles and whether they influenced their perceptions of the four-week course. The course design consisted of 25 to 30 students in a lecture for two to three hours a day across a four-week period. Pre-tests and post-tests were administered to students enrolled in the course to measure their perceptions of the course. Additionally, students completed the Kolb LSI to determine their learning styles. A total of 139 students or 79% of the class was surveyed (Engleberg, Schwenk, & Gruppen, 2001).

The most common of Kolb's learning styles for students in the course were convergers and assimilators. The results confirmed the (Engleberg et al., 2001) hypothesis that most of the medical students were abstract learners, with the majority being convergers and assimilators. Furthermore, while Kolb's learning styles show initial relationships with the pre-test, there were not any significant results in the post-test results. The results measured Kolb's learning styles and accelerated courses. Accelerated courses are a common modality, however, a newer method or modality for learning are social networking sites.

Social networking sites are becoming a new modality for learning. A study was conducted to measure the preference of learning in social networking modalities. The Kolb LSI was administered to measure students' learning styles and how they performed when using the social networking site Facebook (Chen, 2015). One hundred and thirty-four students participated in the study that measured their learning styles. Additionally, the Facebook Use questionnaire was administered to measure student attitudes toward social networking sites. The results of the study showed that assimilators and divergers performed at higher levels in the social networking course, while accommodators and convergers had higher self-efficacy in regards to the social networking site (Chen, 2015). This research suggests that more courses should integrate social networking.

Additional research administering the Kolb LSI, relationships were examined between learning styles and meeting the outcomes of online courses (Hong, Lei, Shu-hong, & Clark, 2007). The students participating in the study were majoring in Educational Technology. One hundred and four students were surveyed with the Kolb LSI, and 40 students were selected to participate in the study. The results failed to show any significant

correlation between the participants' learning styles and the learning outcomes of the course. However, convergers and assimilators did show higher results in learning outcomes than divergers and accommodators (Hong et al., 2007). This study suggests that instructors in online courses should focus on their students' learning styles and redesign the course as needed. Furthermore, the study suggests there should be a large number of resources and sufficient time for students to complete the assignments (Hong et al., 2007).

In another correlational study, Cakiroglu (2014) examined the relationship between Kolb's learning styles, study habits, and learning performances. Three instruments were administered to measure the different variables. The Kolb LSI was administered to examine students' learning styles. An instrument constructed by the researcher was administered to measure students' study habits. The last instrument administered was an achievement test to measure students' learning performance. Sixty-two students enrolled in an online introductory programming course participated in the study. Divergers showed significantly higher results for learning performance than convergers. Additionally, accommodators showed significantly higher results for learning performance than convergers. There were no other significant relationships between Kolb's learning styles and students learning achievement (Cakiroglu, 2014).

McCord, Houseworth, and Michaelsen (2015) also framed their study with Kolb's experiential learning theory. They examined a combined course modality that created an Integrated Business Experience (IBE). The design of the course requires students to be enrolled in business courses and practicum courses, while also starting their own businesses and applying the profits to the community. The researchers suggest that this model follows

Kolb's experiential learning theory and allows students to learn through experience. The abstract conceptualization stage is reflected in the IBE programs in the courses and lectures, which allow the students to think. Another stage of Kolb's experiential learning theory, active experimentation is explored in the practicum through both the assigned homework and fieldwork. Third, concrete experience is reflected by the creation of their own businesses. Lastly, reflective observation is explained through journals, essays, and discussions, allowing the students to reflect on the total experience (McCord, Houseworth, & Michaelsen, 2015). It is suggested that this model applies to all learners. There has been positive feedback from both students and instructors in this model. It is suggested that more programs adapt to this model (McCord et al., 2015).

Kolb's experiential learning theory continues to provide a framework for research in the educational setting. Specifically, course modalities have been explored as a location to apply Kolb's theory. With learning prominent in educational settings, the Kolb LSI has become a popular instrument in measuring students learning styles. The learning styles provide a variable for educational institutions to examine in their research.

CHAPTER THREE: METHODOLOGY

Introduction

Chapter 2 contained an overview of the literature that surrounds developmental education and how Senate Bill 1720 has affected it. Additionally, the literature explored community and state colleges, college readiness, developmental education history, opponents and proponents of developmental education, Senate Bill 1720, compressed developmental education, course modalities, the history of learning styles, learning style models, and Kolb's experiential learning theory. Senate Bill 1720's removal of required assessment testing and changes to developmental education courses affect many students. More research is needed to understand the compression of developmental education (Venezia & Hughes, 2013). Kolb's (1984) experiential learning theory suggests that learning style could influence academic achievement in certain modalities. This chapter describes the methodology of the study and includes the following sections: research design and rationale, research questions, data collection, instrumentation, Kolb's LSI, validity and reliability of Kolb's LSI, setting, participants, and data analysis for the study.

Research Design and Rationale

Before Senate Bill 1720 was passed into law in Florida, students who tested into developmental math, reading, or writing could be required to take these courses by the college they were attending. Furthermore, developmental courses were offered in a traditional 16-week modality. Senate Bill 1720 will now redesign course modalities of developmental education into modularized, compressed, contextualized, corequisite, or as a

gateway course (1720-Education, 2013). These changes affect all students entering a college or university in Florida. Any knowledge that can be generated on the phenomenon can inform students and colleges across Florida. Students with this knowledge can make informed decisions on which modalities best fit their learning styles. Furthermore, Florida state colleges will have a better understanding of the relationship between learning style and academic achievement in developmental education course modalities.

The research design for this study was quantitative, specifically Pearson's chi-square correlational test. The chi-square statistical test was conducted to determine if relationships exists between the variables. The According to Marshall (1996), the type of methodology a researcher selects should be determined by the research questions that are created. The dependent variables for this study was academic achievement. This was measured by collecting student final grades. The independent variable in this study was learning style. This was measured by administering the Kolb LSI to participants. The Pearson chi-square correlational test was selected because the research examined relationships between ordinal and nominal variables.

In quantitative methodology, the goal is to collect and analyze a set of data from a sample that is representative of a larger population (Creswell, 2014). Quantitative research can usually be broken down into experimental designs, where there is a control group, and a nonexperimental design, which are for surveys (Creswell, 2014). This study will implement a nonexperimental design by surveying students who are enrolled in the different developmental math modalities. This research will not have a control group to compare the results against.

Research Questions

The research answers the following questions.

1. Is there a relationship between learning style and academic achievement in a combined modality of developmental math and an accelerated modality of developmental math in a Florida state college in the 2015-2016 academic year?
2. What are student perceptions of combined modalities of developmental math and accelerated modalities of developmental math in a Florida state college in the 2015-2016 academic year?

In order to answer the first research question, the Kolb LSI was administered to students in an accelerated modality of developmental math and a combined modality of developmental math. After collecting data, a Pearson's chi-square correlation test was run to determine if there was a relationship between learning style and academic achievement in both modalities, and individual modalities. In order to answer the second research question, a survey was constructed and administered to students in combined developmental math courses and accelerated developmental math courses. Data that were collected was describes with descriptive statistics. Tables and graphs were created with these data to determine demographic information and perceptions of both modalities.

Much of the research on compressed developmental education modalities has been positive; however, results for math developmental education has been inconsistent (Venezia & Hughes, 2013). This research adds to the small amount of knowledge on math teaching modalities in the state of Florida. The results of the research expand the knowledge of emerging developmental education modalities, specifically math.

Kolb (1984) explains how experience plays a large role in learning. The new developmental education modalities are vastly different from what a traditional developmental classroom offered (Sheldon & Durdella, 2010). It is important to determine if a relationship exists between the success of students, their learning styles, and the different types of developmental math modalities. The results from this research provide both students and colleges more knowledge on the required developmental course modalities. Additionally, this research examines the issue of offering required modalities to students who will be given a different experience than what is offered in a traditional college classroom.

Data Collection

Instrumentation

For the purpose of collecting data for this study, two surveys were administered to students. Kolb's LSI was administered to students to determine their learning styles. Students also completed the additional survey constructed for this research to determine student perceptions of their courses. The data from the Kolb LSI and the survey constructed for this research were administered to students with Qualtrics™, an online survey tool, to better reach students. According to Dillman (2000), internet surveys can allow researchers to reach more of their population. Once data were collected from the surveys, student ID numbers were collected to connect the data to final grades, while also keeping student information confidential.

Data were collected through two main sources. After receiving Institutional Review Board approval, the Kolb LSI and the additional survey were administered to participants by

an email containing a link to the instruments. When participants clicked on the link, they were routed to the consent page informing them of the study and that their personal information would remain confidential. If the participants agreed, they moved forward to complete the Kolb LSI and the additional survey. If they did not agree to give consent, they did not move forward to the instruments.

Once consent was obtained, participants completed the Kolb LSI instrument. Upon completing the Kolb LSI, the participant was administered the survey constructed by the researcher. After the completion of both instruments, participants were thanked for their time and the data were recorded. Additionally, participants were asked for their student identification number, which was later cross-referenced to the final grades in the courses.

Final grades were also collected as data from all sections of MAT 0022C and MAT 0028C by a report created by the college's Institutional Research office. Participants' student identification numbers were later matched with final grades to connect the data. The data were input into SPSS, and statistical analysis was conducted.

The instruments administered for this study were the Kolb LSI and a survey constructed by the researcher. The Kolb LSI is an instrument consisting of 12 open-ended statements. In order to complete the statement, participants ranked four possible answers to the open-ended statements. The answers were ranked, four was the most preferred learning scenario for the participant and one was the least preferred learning scenario for the participant.

Once the participant completed the instrument. The sum of the four categories equaled the participant's score in concrete experience (CE), reflective observation (RO),

abstract conceptualization (AC), and active experimentation (AE). The reflective observation score was subtracted from the active experimentation score to give a participant's AE-RO score. Additionally, the concrete experience score was subtracted from the abstract conceptualization score to give the AC-CE score. The AE-RO score and the AC-AE score were plotted on a grid, the data were marked in one of four quadrants. Once the data were plotted, the participants learning styles were determined. The four learning styles participants measured were accommodators, divergers, assimilators, and convergers.

The survey that was constructed by the researcher was a 10-question survey that gathered data on demographic information and students' perceptions of the MAT 0022C and MAT 0028C courses. The demographic information collected included age, gender, and race and ethnicity. Furthermore, participants were if they liked the format the course was offered in. They were also asked if they believed the course matched their learning styles.

Kolb Learning Style Inventory

There are three advantages of administering the LSI (Cox, 2008). The first is that the instrument is short and easy to understand. Secondly, it should stimulate the processes of learning that occur during a given situation. Lastly, it should be able to predict behavior that is gained from experiential learning (Cox, 2008). The four learning styles that the LSI can predict are accommodating, converging, assimilating, and diverging.

The LSI is constructed of 12 open-ended questions. Participants answered the questions in ranked order, with four total answers that match with the four learning styles (Kolb, 1984). The results collected from the LSI were scored and analyzed to determine the

students' learning styles. Students answered the questions in rank order from one to four, with four indicating the most preferred learning situation and one being the least preferred learning situation. These scores were then analyzed with the Cycle of Learning key to determine the students' learning styles (Kolb, 1985).

Validity and Reliability of Kolb LSI

Researchers have described the Kolb LSI as having high reliability (Geller, 1979; Willcoxson & Prosser, 1996). Across the four learning styles, Cronbach's alpha levels have ranged from .81 to .87 (Willcoxson & Prosser, 1996). While researchers agree the Kolb LSI has proven its validity and reliability, others contend the original LSI can result in unstable results. Within a specific learning style, the original instrument can be stable but when it is applied across Kolb's learning styles, it can be unstable (Ruble & Stout, 1993). Since the creation of the Kolb LSI in 1976, there have been two more versions created (Kolb & Kolb, 2005). While there are a total of three Kolb LSIs, there have been modifications to the LSI 2 and LSI 3.

The first LSI created was originally an experiment to help learners understand experiential learning and their individual experiential learning styles (Kolb & Kolb, 2005). This version was updated to the Kolb LSI in 1976 and became one of the most utilized instruments in research regarding learning. This version contained nine items with four words each. There were internal validity problems with the first incarnation of the instrument. The test showed poor results when being tested and retested (Cox, 2008).

In 1985, the Kolb LSI Version 2 was created due to low reliability and other concerns from the original LSI (Kolb & Kolb, 2005). In order to increase reliability, six items were added. The revised instrument consisted of 12 total items. This change increased the reliability with an average alpha range of .81. The validity continued to increase under this version of the instrument; more than 630 studies were published that administered the revised version. While internal reliability was high, the instrument showed low reliability with test-retest (Kolb & Kolb, 2005). A new reliability study was conducted on the LSI 2 and demonstrated the instrument had lower internal reliability and higher reliability with test-retest. Thus, the new version known as the LSI 2a was created and published in 1993. This change led to the creation of the LSI 3.

In 1999, a color-coded scoring sheet was created from the original LSI 3 making the instrument simpler (Kolb & Kolb, 2005). The instrument now included new application information for teamwork, managing conflict, personal and professional communication, and career choice. The instrument still had the original items for scoring from the LSI 2 test. This inventory also has sections on life and career applications (Kolb, 2000).

In 2005, the LSI 3 added new charts with the application of converting raw LSI scores (Kolb & Kolb, 2005). These charts led to the instrument being named the Kolb LSI 3.1. Other than the small additions, the instrument remained identical to the Kolb LSI 3. For this study, the Kolb LSI 3.1 will be administered. This instrument is the most up-to-date version and has shown the highest levels of validity and reliability thus far.

Setting

The setting for this study was an accelerated developmental math course and a combined developmental math course at a state college in Central Florida. The college setting was a multi-campus system made up of five campuses spread throughout the Orlando metro area. In the 2012-2013 academic year, the student enrollment was approximately 59,958, with the majority of students being traditional college age, between 18-24. Of the students who were enrolled at the college during these years approximately 33% were Caucasian, 17% were African-American, 32% were Hispanic, 5% were Asian, and the remaining 13% were other.

Data were collected from students in Developmental Math II offered in an accelerated modality and Combined Developmental Math offered in a combined modality. Students enrolled in these modalities were surveyed. The first was a shortened version of Developmental Math II, offered in a seven-week modality in contrast to the traditional 16-week modality. The course title is MAT 0028C is a three credit hour course. The second course was a combined version of Developmental Math I and Developmental Math II. The course title is MAT 0022C and is a four credit hour course offered over 13 weeks. Multiple sections of each modality selected to administer the surveys to students. These modalities were chosen because they showed the highest enrollment numbers from the 2014-2015 academic year. The combined MAT 0022C course had a total enrollment of 3,007 students in the 2014-2015 academic year. The accelerated MAT 0028C course had a total enrollment of 2,228 students in the 2014-2015 academic year. Students who were enrolled in these courses

in the summer of 2016 were surveyed near the end of the semester to determine their learning styles and perceptions of the course.

While Senate Bill allows for multiple modalities to be offered in place of a traditional 16-week modality, the compressed modalities were chosen for this research. Compressed developmental math modalities were chosen for this research because the state college that the research was conducted only offered compressed modalities for their developmental courses. The site location chose not to deploy the other available options of developmental education modalities.

Participants

From 2010-2013, the college tracked student success rates in developmental education reading, writing, and math. These data were tracked before Senate Bill 1720 passed into law, so developmental education was required for all students who placed into the courses. Furthermore, developmental courses were offered only in a traditional format. Approximately 53% of students who took developmental math from Fall 2010 through Spring 2013 were successful, passing with a C or better. The success rate for writing was 75%. The success rate for reading was 76%. When these data were compared to the FCS rates at the time, the college was 1% higher in math, 9% higher in writing, and 5% higher in reading. All students enrolled in the developmental course modalities were surveyed and there was no control group.

This research explains if students' learning styles show a relationship with their final grades within the combined and accelerated modalities of developmental math. The research

also discusses the perceptions of combined developmental math and accelerated developmental math courses. Since these courses are now required in the state of Florida, understanding if there is a relationship between student learning styles and academic achievement is significant.

Data Analysis

Introduction

In order to analyze the data effectively, Statistical Package for Social Sciences (SPSS) software was employed. Data were gathered from surveys that were administered to students enrolled in combined developmental math and accelerated developmental math. Once collected, the data were manually input into SPSS for statistical analysis. There was no control group in this study and all students who enrolled in the developmental math courses were surveyed. This provides a limitation, however, did not affect the results. The independent variable was student learning styles. The dependent variable was student academic achievement, this was measured by collecting final grades. The data that were collected for student learning style was nominal data, while final grades were ordinal data. Analyzing these data, statistical tests were applied to create inferential and descriptive statistics used to answer the research questions. An alpha level of .05 was applied to the inferential statistics. The alpha of .05 is selected because it creates less chance of a type II error (Creswell, 2014). A type II error is when the researcher fails to reject the null hypothesis when it should be rejected.

Research Question 1

In order to answer the first research question, a Pearson's chi-square correlational test was conducted. Correlational tests are administered when searching for a relationship between the variables. Furthermore, because the final grade data were ordinal data, a Pearson's chi-square correlation is the appropriate statistical test for this research (Creswell, 2014). An alpha level of .05 was applied. This test explains the relationship between the students' learning styles and their final grades.

Research Question 2

To develop an understanding of student perceptions and demographics, research question two was answered by creating tables of results. Demographics include age, race, and gender. This research developed measures of central tendencies, creating frequency tables, and measuring the mean, median, and mode from the data. The descriptive statistics provides knowledge of the students and how they perceived the course modality they were enrolled in. Descriptive statistics help to visualize the data by presenting them in tables and graphs (Creswell, 2014). The modalities were either the combined developmental math course or the accelerated developmental math course.

Summary

Senate Bill 1720 has required Florida's state college to change the modality in which developmental coursework was traditionally offered. The quantitative methodology selected for this study explains the relationships between the variables in the developmental math modalities. This setting for this study was in the Central Florida area. The college has shown

above average success with developmental education courses when it is compared to FCS success rates.

Students who were enrolled in the college's combined developmental education courses and accelerated developmental education courses were surveyed with the Kolb LSI to determine their learning styles. Additionally, final grades were collected from the students to determine academic achievement. Once the data were collected, a Pearson's chi-square correlation test was conducted to analyze data, answering research question one. Students also completed a survey constructed by the researcher to gather data on students' perceptions of their developmental courses. The data was explained with descriptive statistics to provide information on student demographics and perceptions of the differing developmental math modalities, answering research question two.

CHAPTER FOUR: RESULTS

Introduction

Chapter 4 describes the results from the Kolb LSI, the survey constructed for this research, and the participants' final grades in an accelerated modality of developmental math and a combined modality of developmental math. Furthermore, the results from the data analysis of the correlational tests will be explained. Descriptive statistics from the survey are illustrated with crosstabs that represent demographics and the participants' perceptions of their course modalities.

All participants in this study were enrolled in one of two modalities of compressed developmental math. The first course was a four-credit hour course that combined the traditional Developmental Math I, or MAT 0018C, and the traditional Developmental Math II, or MAT 0028C, and is now being offered as Developmental Math Combined or MAT 0022C. This course, when completed successfully with a C or better, offers a pathway into a college-level math course. The second course was a three-credit hour Developmental Math II course, or MAT 0028C, which has been shortened from a traditional 16-week format and is now offered as a seven-week course. This course also serves as a pathway to college-level math when successfully completed with a C or better.

All participants had a choice between the two modalities when enrolling. However, the differences in both modalities offer a different experience to the student. This research chose Kolb's Theory of Experiential Learning because Kolb explains that learning occurs through experience (Kolb, 1984). If the participants have different experiences in the two modalities, understanding relationships between these courses and Kolb's learning styles is

important. The Kolb LSI was administered to the participants in order to determine their learning styles. Furthermore, the demographics of the participants and their perceptions of the developmental course modalities is important. These results provide more knowledge surrounding correlations between the participants' learning styles and their academic achievement in the developmental math modality that they were enrolled in.

Demographics

The population from which participants were gathered was 513 students, consisting of 318 enrolled in MAT 0022C and 232 enrolled in MAT 0028C. The total number of participants for this study was 121, a 24% response rate. However, of the participants, 95 completed both surveys, 16 declined to participate on the consent form, and 10 began but did not complete both surveys, accounting for missing data. Participants with missing data were not included in this research. From those who responded, 58 (61.1%) were enrolled in MAT 0022C and 37 (38.9%) were enrolled in MAT 0028C. Table 2 shows the breakdown of respondents based on the course that they were enrolled in. The age range varied among participants from 18 through 55. These results were not reports because they had no impact on the research questions.

Table 2: Course

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	MAT 0022C	58	47.9	61.1	61.1
	MAT 0028C	37	30.6	38.9	100.0
	Total	95	78.5	100.0	
Missing	System	26	21.5		
Total		121	100.0		

Participants who completed the survey, 61 (64.2%) responded they were female and 34 (35.8%) responded being male. For race, both Caucasian and Hispanic or Latino had the highest number of responses with 36 (37.9%), followed by African-American at 13 (13.7%), other at eight (8.4%), and Asian/Pacific Islander at two (2.1%); no participant identified as Native American. This information is illustrated in Table 3 and is also represented in Figure 2. Lastly, of all the participants, 43.2% indicated that they were the first in their families to attend college.

Table 3: Race

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	White or Caucasian	36	29.8	37.9	37.9
	Black or African-American	13	10.7	13.7	51.6
	Hispanic or Latino	36	29.8	37.9	89.5
	Asian/Pacific Islander	2	1.7	2.1	91.6
	Other	8	6.6	8.4	100.0
	Total	95	78.5	100.0	
Missing	System	26	21.5		
Total		121	100.0		

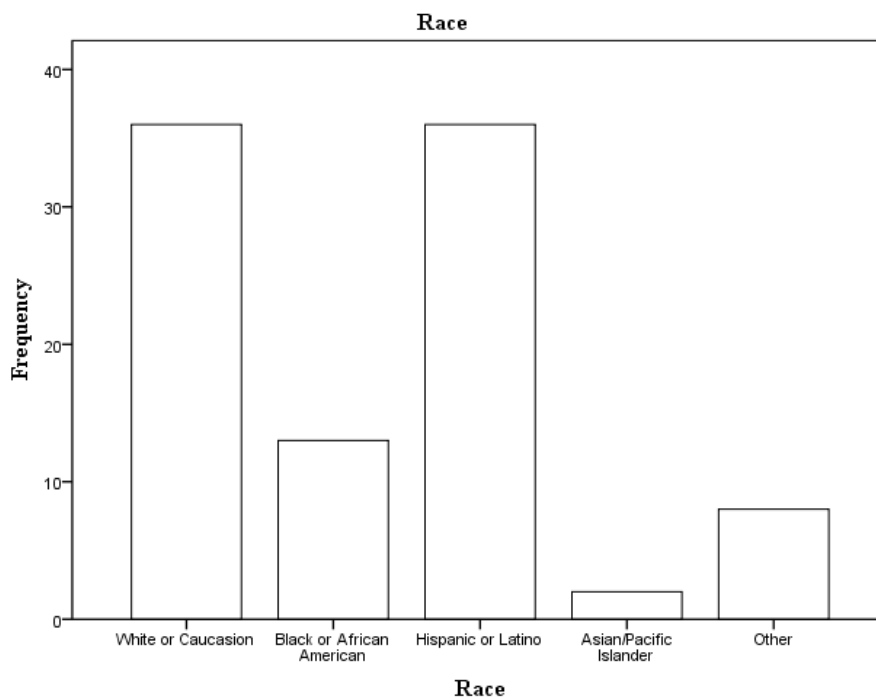


Figure 2: Participant Race.

Table 4 illustrates participant's learning styles. The majority of participants were assimilators at 39 (41.1%). The second highest learning style found was divergers at 27 (28.4%). Convergers were the third highest learning style at 17 (17.9%). Lastly, 12 (12.6%)

participants were accommodators. This is also represented in a bar chart in Figure 3. Figure 4 provides a breakdown of each participant's learning style within the Kolb learning style grid.

Table 4: Participants' Learning Styles

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Accommodator	12	9.9	12.6	12.6
	Diverger	27	22.3	28.4	41.1
	Assimilator	39	32.2	41.1	82.1
	Converger	17	14.0	17.9	100.0
	Total	95	78.5	100.0	
Missing	System	26	21.5		
Total		121	100.0		

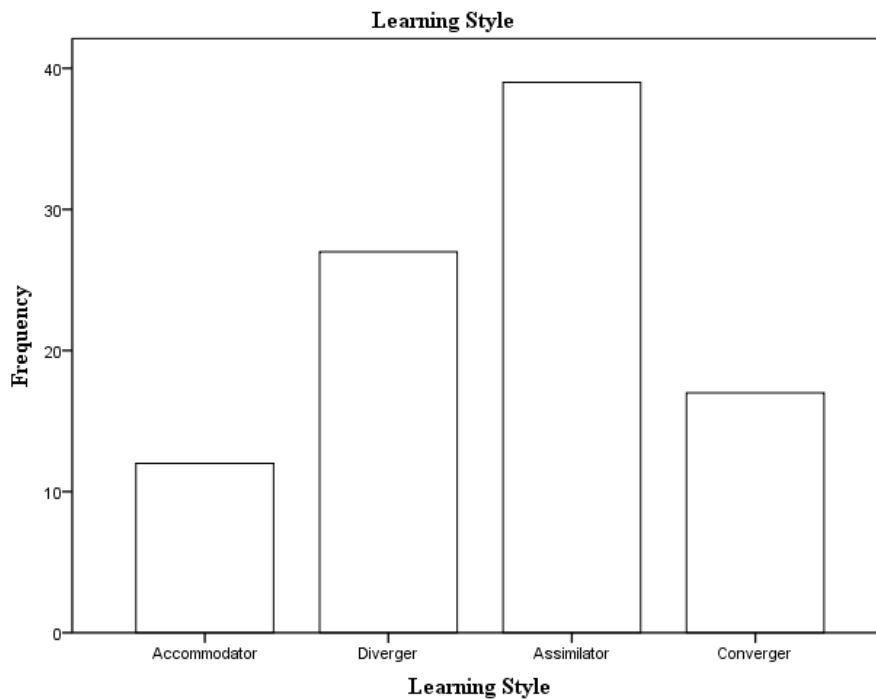


Figure 3: Participants' Learning Styles.

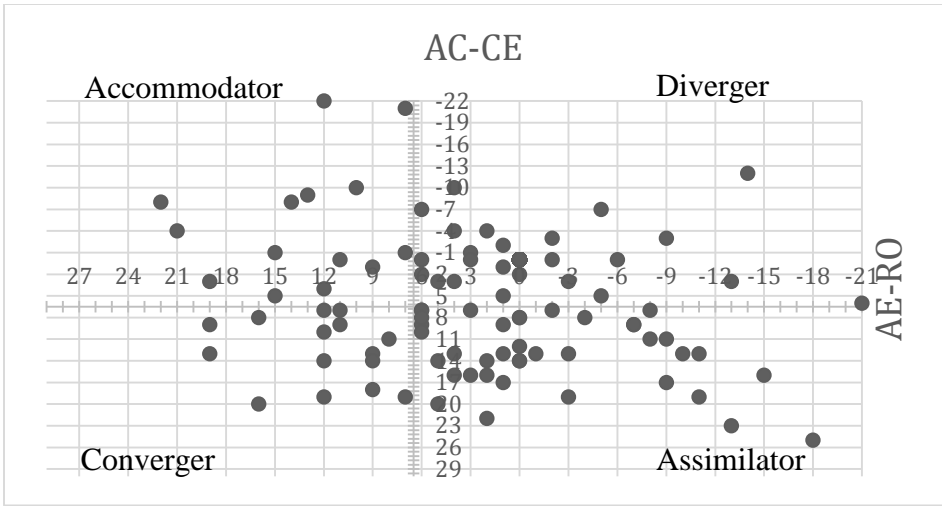


Figure 4: LSI Grid.

Furthermore, of the participants who were enrolled in MAT 0022C, 24 (41.3%) were assimilators, 14 (24.1%) were divergers, 11 (18.9%) were convergers, and nine (15.5%) were accommodators. Of the participants in the MAT 0028C course, 15 (40.5%) were assimilators, 13 (35.1%) were divergers, 6 (16.2%) were convergers, and three (8.1%) were accommodators. These data are shown in Table 5. Additionally, Figures 5 and 6 show the learning styles in the LSI Grid by course.

Table 5: Learning Style by Course

Course	Learning Style				Total
	Accommodator	Diverger	Assimilator	Converger	
MAT 0022C	9	14	24	11	58
MAT 0028C	3	13	15	6	37
Total	12	27	39	17	95

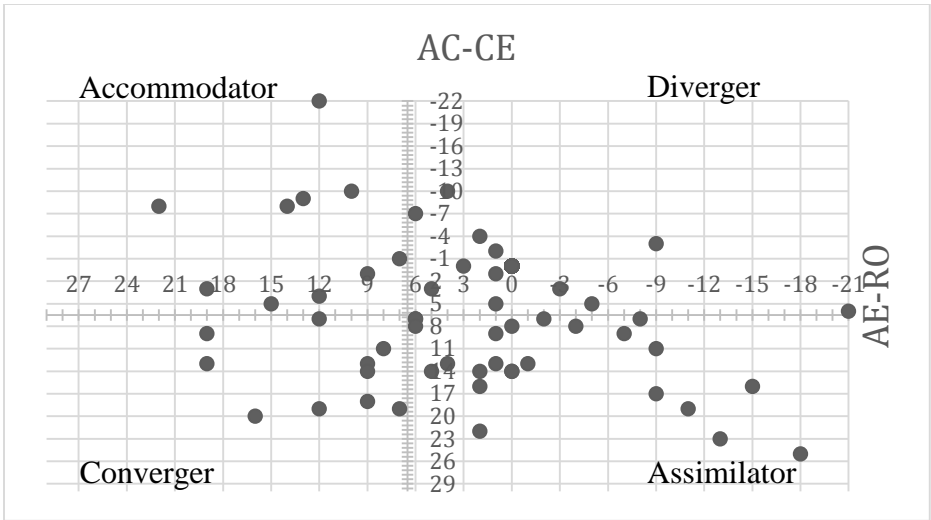


Figure 5: LSI Grid for MAT 0022C.

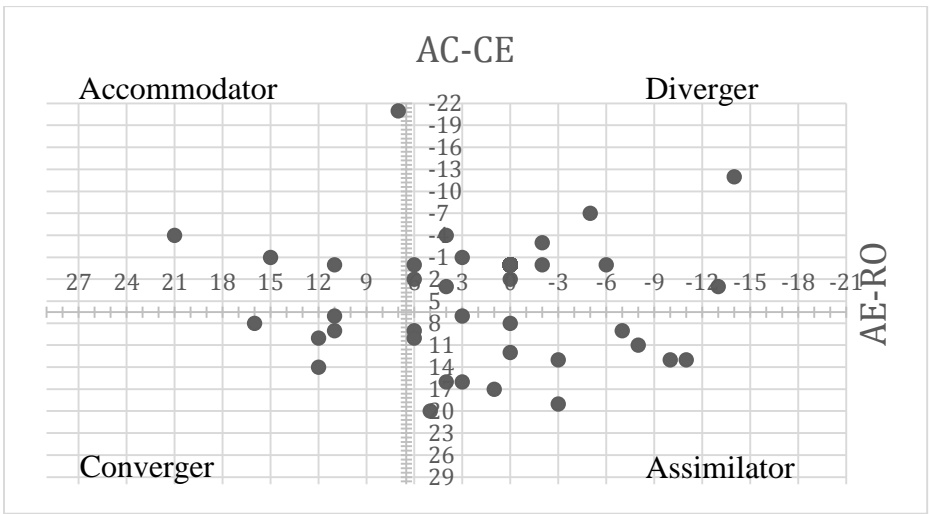


Figure 6: LSI Grid for MAT 0028C.

The final grades collected for this study are illustrated in Table 7. The average grade received of all participants was a B, represented in Table 6. Additionally, this was most frequent grade with 28 (29.5%) participants receiving a B. The second highest grade received

was an A at 26 (27.4%). These grades were followed by C at 23 (24.2%), D at 7 (7.4%), F at 6 (6.3%) and W or withdrawal at 5 (5.3%)

Table 6: Average Final Grades of MAT 0022C and MAT 0028C

Final Grades		
N	Valid	95
	Missing	26
Median		2.0000
Range		5.00

Table 7: Final Grades in MAT 0022C and MAT 0028C

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	A	26	21.5	27.4	27.4
	B	28	23.1	29.5	56.8
	C	23	19.0	24.2	81.1
	D	7	5.8	7.4	88.4
	F	6	5.0	6.3	94.7
	W	5	4.1	5.3	100.0
	Total	95	78.5	100.0	
Missing	System	26	21.5		
Total		121	100.0		

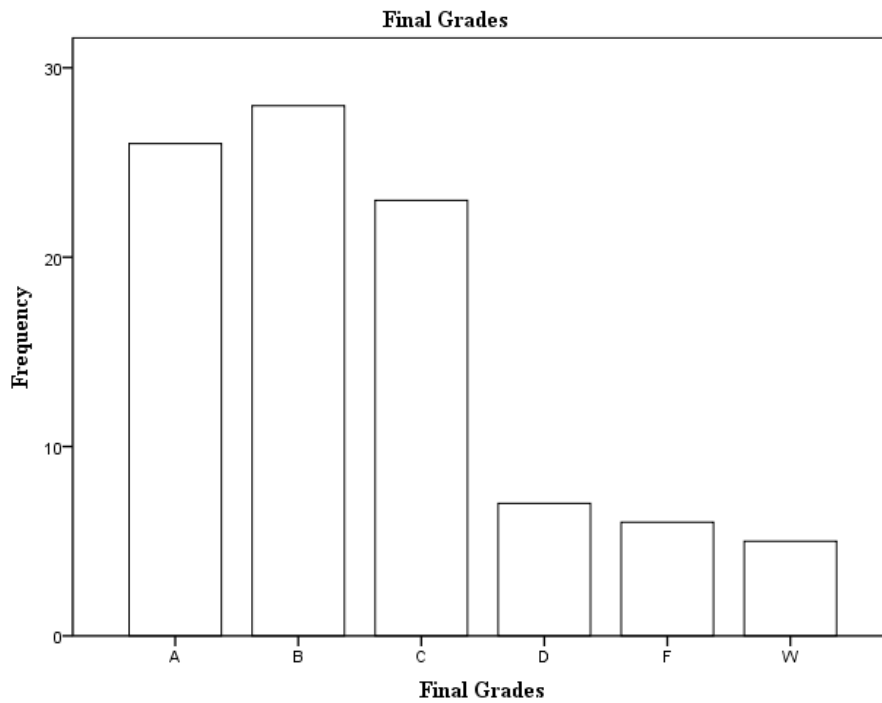


Figure 7: Final Grades in MAT 0022C and MAT 0028C.

In MAT 0022C, the majority of participants earned a C at 17 (29.3%). The second highest grade earned was B with 15 (25.8%). These grades were followed by 14 participants earning A (24.1%), 5 (.08%) earning an F, 4 (.06%) withdrawing from the course, and 3 (.05%) earning a D. In MAT 0028C, the majority of participants earned a B (35.1%). The second highest grade earned was an A at 12 (32.4%), followed by C at 6 (16.2%), D at 4 (10%). Lastly, there was 1 (.02%) participant who earned an F and 1 (.02%) participant who withdrew from the course. This is represented in Table 8.

Table 8: Final Grades by Course

		Course		Total
		MAT 0022C	MAT 0028C	
Final Grades	A	14	12	26
	B	15	13	28
	C	17	6	23
	D	3	4	7
	F	5	1	6
	W	4	1	5
	Total	58	37	95

Table 9 illustrates letter grades by Kolb’s learning styles. Assimilators earned the most As with 10 (38.4%). Assimilators were followed by Convergers earning eight (30.7%), Divergers earning five (19.2%) and Accommodators earning three (11.5%). Assimilators also earned the most Bs with 13 (46.4%), followed by Divergers earning nine (32.1%), and both Accommodators and Convergers earned three (10.7%). Assimilators earned more Cs than any other learning style with eight (34.7%), followed by Divergers earning six (26%), Convergers earning five (21.7%), and Accommodators earning four (17.3%). For Ds, Divergers earned the most with four (57.1%), followed by Assimilators earning two (28.5%), and Accommodators earning one (14.2%). No Convergers who participated in the study earned a D. Along with As, Bs, and Cs, Assimilators also earned the most Fs with five (83.3%). Accommodator was the only other learning style to earn an F, and there was only one (16.6%). Both Divergers and Convergers received no Fs. Lastly, Divergers withdrew from the courses the most with three (60%), followed by Assimilators and Convergers each having one (20%) withdrawal. Accommodators had no withdrawals.

Table 9: Grades by Learning Style

		Final Grades					
		A	B	C	D	F	W
Learning Style	Accommodator	3	3	4	1	1	0
	Diverger	5	9	6	4	0	3
	Assimilator	10	13	8	2	5	1
	Converger	8	3	5	0	0	1
Total		26	28	23	7	6	5

Research Question 1

This section explains the results of the statistical analysis answering research question

1. Research question one is as follows:

Is there a relationship between learning style and academic achievement in a combined modality of developmental math and an accelerated modality of developmental math in a Florida state college in the 2015-2016 academic year?

In order to answer the research question, the raw data were collected through Qualtrics™, an online survey tool. The data from the Kolb LSI were then calculated to determine participants' learning styles. Inferential statistics were conducted to determine

relationships between Kolb's learning styles and final grades participants. Chi-Square tests were conducted to determine correlations between the variables

Correlations Between Learning Styles and Final Grades

A Chi-Square test of independence was conducted to determine relationships between final grades and Kolb's learning styles in an accelerated modality of developmental math and a combined modality of developmental math. The null hypothesis was there are no statistically significant relationship between Kolb's learning styles and final grades in both MAT 0022C and MAT 0028C at an alpha of .05. Table 10 provides a breakdown of the count and expected count of Final Grades and their relationship to the corresponding learning style.

Table 10: Crosstabulation of Learning Styles and Final Grades

		Learning Style				Total	
		Accommodator	Diverger	Assimilator	Converger		
Final Grades	A	Count	3	5	10	8	26
		Expected Count	3.3	7.4	10.7	4.7	26.0
		Standardized Residual	-.2	-.9	-.2	1.6	
	B	Count	3	9	13	3	28
		Expected Count	3.5	8.0	11.5	5.0	28.0
		Standardized Residual	-.3	.4	.4	-.9	
	C	Count	4	6	8	5	23
		Expected Count	2.9	6.5	9.4	4.1	23.0
		Standardized Residual	.6	-.2	-.5	.4	
	D	Count	1	4	2	0	7
		Expected Count	.9	2.0	2.9	1.3	7.0
		Standardized Residual	.1	1.4	-.5	-1.1	
F	Count	1	0	5	0	6	
	Expected Count	.8	1.7	2.5	1.1	6.0	
	Standardized Residual	.3	-1.3	1.6	-1.0		
W	Count	0	3	1	1	5	
	Expected Count	.6	1.4	2.1	.9	5.0	
	Standardized Residual	-.8	1.3	-.7	.1		
Total	Count	12	27	39	17	95	
	Expected Count	12.0	27.0	39.0	17.0	95.0	

In order to meet the assumptions of Pearson's Chi-Square no more than 20% of cells should have an expected count of less than five. Table 11 represents that the assumptions for Pearson's Chi-Square have not been met because 17 (70.8%) cells have an expected value of less than five. Furthermore, there is not a statistically significant relationship between Kolb's

learning styles and final grades in either MAT 0022C or MAT 0028C. Pearson χ^2 (df=15, N=95) = 17.31, p=.301, phi=.427. Likelihood ratio (df=15, N=95) = 20.378, p=.158. The phi statistic indicates a large effect size and is shown in Table 12. Furthermore, this research fails to reject the null hypothesis.

Table 11: Chi-Square Test for Learning Styles and Final Grades

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	17.309 ^a	15	.301
Likelihood Ratio	20.378	15	.158
Linear-by-Linear Association	1.326	1	.249
N of Valid Cases	95		

^a 17 cells (70.8%) have expected count less than 5. The minimum expected count is .63.

Table 12: Effect Size for Learning Styles and Final Grades

	Value	Approximate Significance
Nominal by Phi	.427	.301
Nominal Cramer's V	.246	.301
N of Valid Cases	95	

Correlations Between Learning Styles and Final Grades in MAT 0022C

A Chi-Square test of independence was conducted to determine relationships between final grades and Kolb's learning styles in a combined modality of developmental math. The null hypothesis was there are no statistically significant relationships between Kolb's

learning styles and final grades in MAT 0022C at an alpha of .05. Table 13 provides a breakdown of the count and expected count of Final Grades and their relationship to the corresponding learning style.

Table 13: Crosstabulation for Learning Styles and Final Grades in MAT 0022C

Course			Learning Style				Total	
			Accommodator	Diverger	Assimilator	Converger		
MAT 0022C	Final Grades	A	Count	2	3	6	3	14
		Expected Count	2.2	3.4	5.8	2.7	14.0	
		Standardized Residual	-.1	-.2	.1	.2		
	B	Count	3	4	6	2	15	
	Expected Count	2.3	3.6	6.2	2.8	15.0		
		Standardized Residual	.4	.2	-.1	-.5		
	C	Count	3	4	5	5	17	
	Expected Count	2.6	4.1	7.0	3.2	17.0		
		Standardized Residual	.2	-.1	-.8	1.0		
	D	Count	0	1	2	0	3	
	Expected Count	.5	.7	1.2	.6	3.0		
		Standardized Residual	-.7	.3	.7	-.8		
	F	Count	1	0	4	0	5	
	Expected Count	.8	1.2	2.1	.9	5.0		
		Standardized Residual	.3	-1.1	1.3	-1.0		
	W	Count	0	2	1	1	4	
	Expected Count	.6	1.0	1.7	.8	4.0		
		Standardized Residual	-.8	1.1	-.5	.3		
	Total	Count	9	14	24	11	58	
		Expected Count	9.0	14.0	24.0	11.0	58.0	

In order to meet the assumptions of Pearson’s Chi-Square no more than 20% of cells should have an expected count of less than five. Table 14 represents that the assumptions for Pearson’s Chi-Square have not been met because 21 (87.5%) cells have an expected value of less than five. Furthermore, there is not a statistically significant relationship between Kolb’s learning styles and final grades in MAT 0022C. Pearson χ^2 (df=15, N=58) = 9.910, p=.825, phi=.413. Likelihood ratio (df=15, N=58) = 12.946, p=.606. The phi statistic indicates a large effect size and is reported in Table 15. Therefore, this research fails to reject the null hypothesis.

Table 14: Chi-Square Test for Learning Styles and Final Grades in MAT 0022C

Course		Value	df	Asymptotic Significance (2-sided)
MAT 0022C	Pearson Chi-Square	9.910 ^b	15	.825
	Likelihood Ratio	12.946	15	.606
	Linear-by-Linear Association	.019	1	.891
N of Valid Cases		58		

^b 21 cells (87.5%) have expected count less than 5. The minimum expected count is .47.

Table 15: Effect Size by Course

Course			Value	Approximate Significance
MAT 0022C	Nominal by	Phi	.413	.825
	Nominal	Cramer's V	.239	.825
	N of Valid Cases		58	
MAT 0028C	Nominal by	Phi	.713	.222
	Nominal	Cramer's V	.412	.222
	N of Valid Cases		37	
Total	Nominal by	Phi	.427	.301
	Nominal	Cramer's V	.246	.301
	N of Valid Cases		95	

Correlations Between Learning Styles and Final Grades in MAT 0028C

A Chi-Square test of independence was conducted to determine relationships between final grades and Kolb's learning styles in an accelerated modality of developmental math. The null hypothesis was there are no statistically significant relationships between Kolb's learning styles and final grades in MAT 0028C at an alpha of .05. Table 16 provides a breakdown of the count and expected count of Final Grades and their relation to the corresponding learning style.

Table 16: Crosstabulation for Learning Styles and Final Grades in MAT 0028C

Course			Learning Style				Total	
			Accommodator	Diverger	Assimilator	Converger		
MAT 0028C	Final Grades	A	Count	1	2	4	5	12
		Expected Count	1.0	4.2	4.9	1.9	12.0	
		Standardized Residual	.0	-1.1	-.4	2.2		
	B	Count	0	5	7	1	13	
	Expected Count	1.1	4.6	5.3	2.1	13.0		
	Standardized Residual	-1.0	.2	.8	-.8			
	C	Count	1	2	3	0	6	
	Expected Count	.5	2.1	2.4	1.0	6.0		
	Standardized Residual	.7	-.1	.4	-1.0			
	D	Count	1	3	0	0	4	
	Expected Count	.3	1.4	1.6	.6	4.0		
	Standardized Residual	1.2	1.3	-1.3	-.8			
	F	Count	0	0	1	0	1	
	Expected Count	.1	.4	.4	.2	1.0		
	Standardized Residual	-.3	-.6	.9	-.4			
	W	Count	0	1	0	0	1	
	Expected Count	.1	.4	.4	.2	1.0		
	Standardized Residual	-.3	1.1	-.6	-.4			
	Total	Count	3	13	15	6	37	
	Expected Count	3.0	13.0	15.0	6.0	37.0		

In order to meet the assumptions of Pearson’s Chi-Square no more than 20% of cells should have an expected count of less than five. Table 17 represents that the assumptions for Pearson’s Chi-Square have not been met because 23 (95.8%) cells have an expected value of less than five. Furthermore, there is not a statistically significant relationship between Kolb’s learning styles and final grades in MAT 0028C. Pearson χ^2 (df=15, N=37) = 18.811, p=.222, phi=.713. Likelihood ratio (df=15, N=37) = 21.517, p=.121. The phi statistic indicates a large effect size and is reported in Table 15. Therefore, this research fails to reject the null hypothesis.

Table 17: Chi-Square Test for Learning Styles and Final Grades in MAT 0028C

Course		Value	df	Asymptotic Significance (2-sided)
MAT 0028C	Pearson Chi-Square	18.811 ^c	15	.222
	Likelihood Ratio	21.517	15	.121
	Linear-by-Linear Association	6.013	1	.014
N of Valid Cases		37		

^c 23 cells (95.8%) have expected count less than 5. The minimum expected count is .08.

Research Question 2

This section explains the results of the statistical analysis answering research question

2. Research question two is as follows:

What are student perceptions of combined modalities of developmental math and accelerated modalities of developmental math in a Florida state college in the 2015-2016 academic year?

In addition to completing the Kolb LSI, participants responded to the survey that was developed by the researcher to determine demographics and information on perceptions their development math course modality. The average response to the perception of math prior to enrolling in their current developmental course modality was neutral. This is represented in Table 18. Additionally, neutral was the most frequent response at 25 (26.3%). The second highest response was extremely disliked at 24 (25.3%). These responses were followed by extremely liked and somewhat disliked at 19 (20%) responses each. Lastly, somewhat liked had eight (8.4%) responses. These figures are represented in Table 19 and Figure 8.

Table 18: Average Perception of Math Before Current Math Modality

N	Valid	95
	Missing	26
Median		3.00
Range		4

Table 19: Perception of Math Before Current Math Modality

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Extremely Liked	19	15.7	20.0	20.0
	Somewhat Liked	8	6.6	8.4	28.4
	Neutral	25	20.7	26.3	54.7
	Somewhat Disliked	19	15.7	20.0	74.7
	Extremely Disliked	24	19.8	25.3	100.0
	Total	95	78.5	100.0	
	Missing System	26	21.5		
Total		121	100.0		

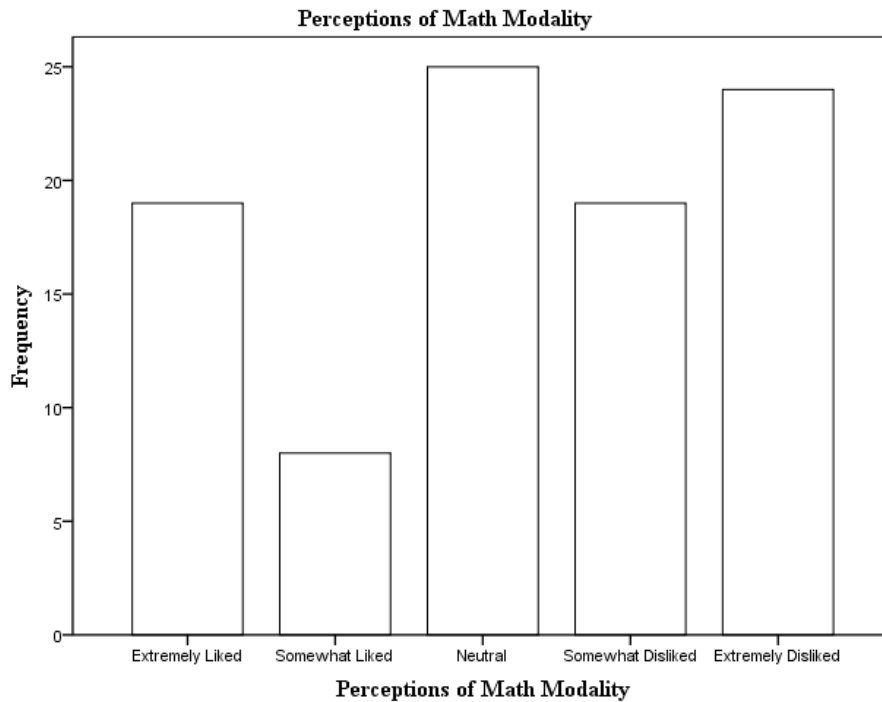


Figure 8: Perceptions of Math Before Current Math Modality.

When participants were surveyed regarding the modality of the course, the majority 74 (77.9%) stated they preferred the format that the course was offered in, while 21 (22.1%) did not prefer the format of the course. This is represented in Table 20. Furthermore, of the participants who were enrolled in MAT 0022C, 44 (75.8%) did prefer the modality of the course, while 14 (24.1%) did not prefer the modality of the course. Participants who took MAT 0028C, 30 (81%) preferred the modality of the course, while seven (12%) did not prefer the modality of the course. This is represented in Table 21.

Table 20: Participants' Preference for Math Modality

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	74	61.2	77.9	77.9
	No	21	17.4	22.1	100.0
	Total	95	78.5	100.0	
Missing	System	26	21.5		
Total		121	100.0		

Table 21: Participants' Preference by Course

		Course		Total
		MAT 0022C	MAT 0028C	
Participant Preferred	Yes	44	30	74
Math Modality	No	14	7	21
Total		58	37	95

Additionally, the majority of participants, 79 (83.2%), responded that the modality of their math courses helped them prepare for college-level mathematics. Additionally, just 16 (16.8%) responded the modality did not prepare for college-level mathematics. This is shown in Table 22 and is also represented in Figure 9.

Table 22: Modality Prepared Students for College-Level Courses

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	79	65.3	83.2	83.2
	No	16	13.2	16.8	100.0
	Total	95	78.5	100.0	
Missing	System	26	21.5		
Total		121	100.0		

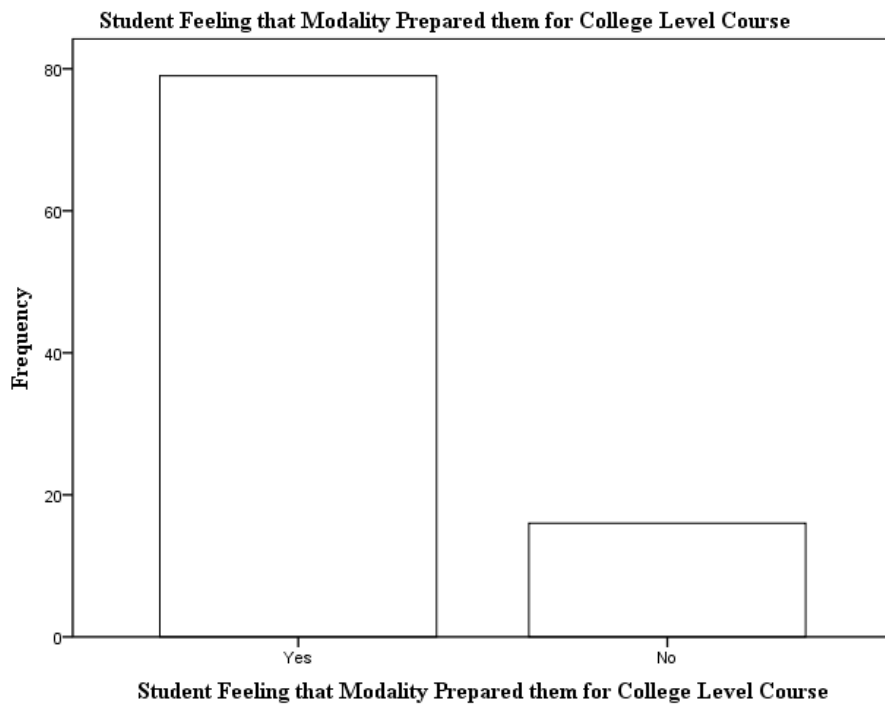


Figure 9: Modality Prepared Students for College-Level Courses.

The majority of the participants selected yes when asked if they felt the course modality matched their learning styles. Sixty-six (69.5%) felt that the course modalities matched their learning styles, while 29 (30.5%) did not feel that the course matched their learning styles. This is represented in Table 23. Table 24 illustrates the different learning styles and perceptions of course modalities that matched their learning styles.

Accommodators were divided about their learning style matching the course modality, with seven (58.3%) responding the course modality did fit their learning style and five (41.6%) responding the course modality did not match their learning style. For divergers, 17 (62.9%) responded the course modality fit their learning style, while 10 (37.1%) responded the course modality did not match their learning style. The majority of assimilators responded the course modality fit their learning style with 28 (71.7%) and 11 (28.2%) responding the

course modality did not match their learning style. Lastly, the majority of convergers, 14 (82.3%), responded the course modality did fit their learning style, while three (17.6%) responded the course modality did not match their learning style. Furthermore, participants who were enrolled in MAT 0022C, 36 (62%) responded the course matched their learning styles, while 22 (37.9%) responded the course did not match their learning styles. Participants enrolled in MAT 0028C, 30 (81%) responded the course matched their learning styles and seven (18.9%) responded the course did not match their learning styles. These numbers are represented in Table 25.

Table 23: Modality Matched Learning Style

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	66	54.5	69.5	69.5
	No	29	24.0	30.5	100.0
	Total	95	78.5	100.0	
Missing	System	26	21.5		
Total		121	100.0		

Table 24: Modality Fit by Individual Learning Style

		Learning Style				Total
		Accommodator	Diverger	Assimilator	Converger	
Student Feeling that Course Fit Learning Style	Yes	7	17	28	14	66
	No	5	10	11	3	29
Total		12	27	39	17	95

Table 25: Modality Fit by Course

		Course		Total
		MAT 0022C	MAT 0028C	
Student Feeling that	Yes	36	30	66
Course Fit Learning	No	22	7	29
Style				
Total		58	37	95

Conclusion

Chapter 4 explained the results of the research, including data collection and statistical analysis. The research questions were answered by analyzing the data collected from the Kolb LSI, student final grades, and the additional survey. These data were analyzed through correlational tests to determine relationships between different learning styles and academic final grades in a combined modality of developmental math and an accelerated modality of developmental math. The results demonstrate that there were no statistically significant correlations between Kolb’s learning styles and final grades in compressed modalities of developmental math. Furthermore, there were no statistically significant correlations between Kolb’s learning styles and final grades in MAT 0022C. Lastly, there were no statistically significant correlations between Kolb’s learning styles and final grades in MAT 0028C.

Additionally, descriptive statistics were illustrated with the data collected to explain the participants’ perceptions of the developmental math course modalities. The results determined the majority 74 (77.9%) preferred the modality the courses were offered in, while

21 (22.1%) did not prefer the modalities of the courses. Furthermore, the majority of participants, 79 (83.2%), responded their developmental math modality helped them prepare for college-level mathematics, while just 16 (16.8%) responded their developmental math modality did not help them prepare for college-level mathematics. Lastly, the majority of the participants also responded yes when asked if they believed the course modality matched their learning styles, with 66 (69.5%) while just 29 (30.5%) responded the course modality did not match their learning style.

In conclusion, Chapter 4 has provided the results of the data and has answered the research questions. Chapter 5 will provide a summary of the results and explaining the answers to both research questions. Additionally, Chapter 5 will discuss the limitations of the study, recommendations, and possible future research related to the topic.

CHAPTER FIVE: DISCUSSION

Introduction

The purpose of this study was to find relationships between students' learning styles and their success in differing modalities of developmental education courses. This knowledge is important because the state of Florida mandates new modalities of developmental education, including compressed modalities. Chapter 5 provides an explanation of the results from the statistical analysis, limitations, implications, and recommendations for future research.

In Florida, Senate Bill 1720 has implemented required changes to developmental education modalities in state colleges and universities. Developmental courses in reading, writing, and mathematics can no longer be designed as a traditional 16-week course. Additionally, students who graduate Florida public high schools in 2007 or later are no longer required to take assessment tests measuring college readiness. Compressed modalities of developmental education were employed recently, amounting to a small amount of research on the topic.

This research focused specifically on developmental math courses offered at a Florida state college. The modalities that were examined were an accelerated version of Developmental Math II, also known as MAT 0028C, and a combined version of Developmental Math I and II, known as MAT 0022C. MAT 0028C was offered across 7 weeks, while MAT 0022C was offered across 13 weeks. Both courses were offered in the summer term, when compared to the fall and spring terms, is 3 weeks shorter. All students enrolled in the courses were given the opportunity to participate in this study.

The instrument that was administered to determine Kolb's learning styles was the Kolb LSI. This instrument explained which of the four learning styles the participants were. These learning styles are divergers, accommodators, convergers, and assimilators. Statistical analysis was conducted to determine the relationships between participants learning styles and academic achievement in an accelerated modality of developmental education and a compressed modality of developmental education.

Through the administering of the Kolb's Learning Style Inventory, this research has provided an understanding about student learning styles and relationships with academic achievement in compressed developmental courses, specifically developmental math. The findings from these analyses are presented in this chapter.

Discussion

Understanding relationships between student learning styles and academic achievement in compressed developmental education is imperative because the merging modalities are required in Florida. This research provides more knowledge surrounding the phenomenon of compressed developmental math modalities, student learning styles, and student achievement. This study was guided by two research questions. Is there a relationship between learning style and academic achievement in a combined modality of developmental math and an accelerated modality of developmental math in a Florida state college in the 2015-2016 academic year and What are student perceptions of combined modalities of developmental math and accelerated modalities of developmental math in a Florida state college in the 2015-2016 academic year?

Research Question 1

Research question one examined the relationship between Kolb's learning styles and final grades from participants enrolled in MAT 0022C and MAT 0028C during the summer term at a Florida state college. The null hypotheses (there are no statistically significant relationships between learning style and final grades in both MAT 0022C and MAT 0028C at an alpha of .05, there are no statistically significant relationships between learning style and final grades in both MAT 0022C at an alpha of .05, and there are no statistically significant relationships between learning style and final grades in both MAT 0028C at an alpha of .05) were all accepted.

The first null hypothesis was accepted. Correlations were examined between all final grades and all learning styles in the accelerated modalities and the combined modalities of developmental math. There was no statistically significant correlation found between the variables. It can be assumed that the variables are independent of one another. The second null hypothesis was also accepted. There was no statistically significant relationship found between learning styles and final grades in MAT 0022C. This research suggests that final grades and Kolb's learning styles are independent of one another in MAT 0022C. The final null hypothesis was also accepted. No statistically significant relationship was found between final grades and Kolb's learning styles in MAT 0028C. Kolb's learning styles do not show any impact in influence or relationship on final grades in MAT 0028C.

This research has found that there are no statistically significant correlations or relationships between Kolb's learning styles and academic achievement in an accelerated modality and a combined modality of developmental math at a Florida state college in the

2015-2016 academic year. However, this does not infer that no association exists between the variables. It is possible that with a larger sample, relationships could be significant.

Furthermore, these results do not imply that there are no associations between Kolb's learning styles and academic achievement in compressed developmental math courses nationwide. Given that this study chose to examine only students at a state college in Florida, the research suggests only that the two variables, student learning styles and final grades, are independent at the particular state college in Florida.

Kolb's learning styles were tested as the independent variable in this research because Kolb's learning styles represent the preference for learning through experience. Both MAT 0022C and MAT 0028C offer different learning experiences because one course, MAT 0022C, is a combination of two courses into one and the other course, MAT 0028C, is a course offered at an accelerated pace. This research examined the relationships between Kolb's learning styles and academic achievement for students enrolled in compressed modalities of developmental math. No relationships were found between the variables. However, this research does provide further knowledge regarding compressed modalities and Kolb's learning styles in the state of Florida.

Research Question 2

Research question two examined students' perceptions of two different compressed modalities of compressed developmental math in a Florida state college in the 2015-2016 academic year. In order to answer the research question, it was important to understand if students showed any bias toward mathematics. According to results of the survey, feelings

toward mathematics were split. Responses varied for the participants. Both positive and negative perceptions of mathematics were seen. However, even with participants responding with mixed results toward mathematics prior to taking the course, they did express favoritism towards the modality of the course.

Participants expressed a preference toward the modalities that their courses were offered in. An overwhelming 77.9% said that they preferred the individual developmental math modality they were enrolled in. Furthermore, the results were not skewed toward one course: 75.8% of those who were enrolled in MAT 0022C said that they preferred the modality the course was taught while 81% of those who were enrolled in MAT 0028C said that they preferred their modality.

In addition to participants' preferring the modality their courses were taught in, they also believed the courses prepared them for college-level mathematics. The majority of participants, 83.2%, expressed their developmental math modality was preparing them for college-level mathematics. These results indicate that students believed they were learning in the courses. This is further supported by the final grades of students. Of all the participants in both courses, only 18.9% received a grade of D, F, or W. The remaining 81.1% received a passing grade of A, B, or C.

The majority of participants also expressed they believed the modality matched their learning style, another indicator that participants had a positive perception of their math modality. Furthermore, 69.5%, felt that the course matched their learning styles. These results explain that participants believe that the modality that they took for developmental math paired well with how they learn.

Participants in this study expressed a positive preference toward the math modalities in both MAT 0022C and MAT 0028C in a Florida state college in the 2015-2016 academic year. Furthermore, majority of participants preferred the math modalities, while the results were split for math preference. These courses seem to be preferred by students who must take them, and this research can assist in future research regarding compressed course modalities.

The results given from the survey were answered through descriptive statistics. Because this research is not generalizing the results across all students and only students at a State College in Florida, this method was selected. Lastly, these results also support the positive literature surrounding compressed developmental education modalities and helps provide knowledge to colleges and researchers in the future.

Limitations

There are five limitations for this study, including the limited population of the study. This research focused only on students located in one state college in central Florida, however all students in Florida are impacted. Therefore, the results may not be representative of all the state colleges and universities in Florida.

This research only examined two of the modalities the state now requires, accelerated and combined. This provides another limitation to the study. Additionally, state of Florida requires that developmental education courses also be offered in modularized or contextualized formats, or as a gateway modality. These modalities are not offered for the specific developmental math courses that were researched.

Math is the discipline that was examined for this study, however, developmental education is also offered in reading and writing. This provides another limitation of the study: not all disciplines of developmental courses were researched. Furthermore, developmental reading and writing are also offered in both compressed and accelerated formats, which could provide more knowledge on compressed modalities.

Another limitation of this research is the profession of the researcher. The researcher is an employee at a state college that was affected by Senate Bill 1720. While this did not affect the study, it is important to disclose that the researcher was knowledgeable about the impact the bill might have on students. Furthermore, it was the intention of the researcher to generate more knowledge on the topic so that future students can benefit from this research.

Data were collected through an email sent out to all participants, creating another limitation. This strategy accounted for the 24% response rate. Dillman (2000) explains that internet surveys often have low response rates. Response rates may have been higher if another method was chosen. Paper surveys administered in person, might have increased the response rates.

Lastly, the recent passing of Senate Bill 1720 into law accounted for limited research on the topic. Because this phenomenon is so new, there are no prior research to base the study on. This research can now help future researchers who plan to look at the impact of developmental education modalities on students.

Recommendations

Based on the results of this study, there are several recommendations presented. These recommendations are directed at colleges and universities, Florida legislators, and any future research that may be conducted on the topic of developmental education modalities. These recommendations are presented in this section.

Colleges and Universities

It is paramount that leaders of Florida state colleges and universities continue to examine the impact that Senate Bill 1720 has on students. These institutions must measure the success of students enrolled in differing modalities of developmental education to see if there are any patterns. It is important to continue exploring learning styles and how students can benefit their learning preferences. Understanding how learning occurs, institutions can provide better environments for their students.

Senate Bill 1720 prohibits required assessment of students, however, colleges and universities must find ways to introduce assessment voluntarily to students. While this research did not find any relationships between learning styles and final grades, personality inventories can assist colleges and universities understand their students. Chapter 2 provided some positive research regarding the success of applying learning inventories towards classroom success. Furthermore, the limitation of a smaller sample for this study, may have impacted the results. Learning inventories will inform leaders at college and universities about the kind of learners their students are.

Lastly, colleges and universities must build the curriculum of the developmental courses around learning style of students. While the findings suggest there is no relationship between Kolb's learning styles and academic success for students, it does not suggest there are no relationships between academic achievement and all personality assessments. Future research administering other inventories is crucial.

Faculty

Faculty play a crucial role in the success of students enrolled in emerging modalities of developmental education modalities. This study showed that grades earned in an accelerated modality and a combined modality of developmental math were positive. Of the 95 the participants, 77 (81%) earned either an A, B, or C when examining the compressed modalities of developmental math. In MAT 0022C, 46 (79.3%) participants earned a grade of A, B, or C in the course. In MAT 0028C, 31 (83.7%) participants earned a grade of A, B, or C grades. These grades represent that the majority of students are showing success in these courses. It is recommended that faculty continue to instruct the courses as they were designed.

While most students did show success in the compressed modalities of developmental education, there was a larger percentage of students who did not perform well in the combined modality of developmental math when compared to accelerated development math. A total of 12 (20.6%) students earned a D or F, or withdrew from the combined modality of developmental math. A total of 6 (16.2%) students earned either a grade of D or F, or withdrew from the course. It is important for faculty teaching sections of combined

developmental math to identify these students in order to assist them in progressing through the course. Combined courses must be examined by faculty to determine if the combination of courses are too rigorous for students. While the majority of students were successful in this course, there was still a large percentage of students who were unsuccessful. Furthermore, 4 students withdrew from the combined course compared to only 1 from the accelerated modality of the course. While this represents only a small portion of the participants, this is something that faculty who teach the combined modality of the course should be aware of.

Students

Senate Bill 1720 has redesigned the modalities of developmental education in the state of Florida for the foreseeable future. Furthermore, it is students who will be impacted by these changes. This research examined the relationships that existed between student learning styles and academic achievement in compressed modalities of developmental math courses. This research presents the following recommendations to students who are impacted by this bill.

The learning styles that were most prevalent among the participants of this study were assimilators and divergers. There were 39 (41.1%) participants who were assimilators and 27 (28.4%) participants who were divergers. While there were more assimilators and divergers represented than accommodators and convergers, this did not perform as well as the other learning styles.

Convergers performed the best in the compressed courses with 8 (47%) receiving. Counter to this, assimilators received the most failing grades in the course with 5 (12.3%)

earning an F and 1 (.02%) students withdrawing from their course. Institutions must consider designing these course based on students learning styles in order to increase students' academic achievement.

This research suggests that assimilators and divergers were most prevalent in the compressed modalities of developmental math. Assimilators show a preference for logical conclusions, while divergers prefer to apply their imaginations. While these can be very different learning styles, it is still possible for compressed modalities to be reconsidered to fit the learning styles of both. Curriculum could include assignments developed for both learning styles. Providing a holistic learning experience will also allow the students to develop in the areas of learning they may not show a preference for.

In conclusion, institution should consider the preference for which students learn. While the modalities of the course cannot be redesigned, curriculum could be reexamined to in order to fit the preferences of a student in the course. Furthermore, if students were required or encouraged to complete the Kolb LSI prior to enrolling into the courses, the institutions could different pedagogical techniques to assist in improving students' academic achievement.

Florida Legislators

It is recommended Florida legislators spend more time collecting data and conducting research on students that have been affected by Senate Bill 1720. Not only should students enrolled in emerging modalities be examined but students who have bypassed assessment

testing should also be studied. It is still unknown how Senate Bill 1720 will impact these students. More research is needed regarding Senate Bill 1720 to inform state legislators.

It is recommended that state legislators allow required personality testing upon entry to a college or university. The results of the personality assessments may help institutions provide better options for their students. Furthermore, institutions would have flexibility in assessing the learning styles of their students to determine which are most successful. Lastly, it is recommended that state legislators listen to the advice of leaders at Florida institutions. Senate Bill 1720 was questioned by leaders of state college. Legislators must consult with experts in the field of higher education before making decisions.

Future Research

Senate Bill 1720 must continue to be examined. It is recommended that research be conducted on students who have chosen to bypass assessment testing upon entering college. Furthermore, a comparative study looking at the success rates of students who enrolled developmental education and those who did not enroll in developmental education is suggested.

Another recommendation for future research is to recreate this study with both reading and writing courses. As mentioned in the previous section, a limitation of this study was not examining the relationships between Kolb's learning styles and academic achievement in compressed developmental reading and writing courses. This research will create more knowledge on the differing disciplines effected by Senate Bill 1720.

Lastly, research conducted examining faculty is recommended. A qualitative study to gain insight on the new developmental course modalities from faculty may assist in understanding how these changes have affected the instructional methods of the courses. Understanding how the learning environment has changed is important to understand. Furthermore, examining college math and English courses qualitatively from faculty may help understand if there are more students enrolled these course who are not prepared. This would create knowledge on the students who chose not to take an assessment test when entering the institution.

Conclusions

Developmental education in Florida has been systematically changed in two ways since Senate Bill 1720 passed into law in 2013. The first was the abolishment of required assessment by colleges and universities for any student who graduated from a Florida public high school in 2007 or later. The second change redesigned developmental education courses. Furthermore, developmental courses must now be offered in modularized instruction, compressed instruction, contextualized instruction, corequisite instruction, or as gateway courses. The purpose of this research was to provide knowledge on the topic of the new developmental education modalities.

Students enrolled in compressed modalities of a developmental math and students enrolled in combined modalities of a developmental math were surveyed. The instrument that was administered was the Kolb LSI, which measured the learning styles of the students. The four learning styles that were observed were accommodators, assimilators, divergers, and

convergers. Furthermore, participants also completed a survey created for this research to determine demographic information and their perceptions of their developmental math courses.

In addition to the data collected from the surveys, data were also collected on the final grades received in MAT 0022C and MAT 0028C. These data were collected from the college's institutional research department. Once all the data were collected, SPSS was employed to conduct statistical analysis.

The results of research question 1 found no statistically significant relationships between Kolb's learning styles and academic achievement in MAT 0022C and MAT 0028C. Furthermore, when looking at the modalities individually, no statistically significant relationships were found between the variables. It is important to note that while no relationships were found between final grades and Kolb's learning styles in this study, the research is implying only that the variables were independent at the state college in Florida where the research took place. Lastly, more research is recommended regarding relationships between personality types and academic achievement in all modalities and disciplines of developmental education.

The results of research question 2 found students prefer compressed modalities of math. Responses to survey questions explained the majority of participants enjoyed the modalities, believed the modalities fit their learning styles, and believed that the modalities prepared them for college-level mathematics. Additionally, the majority of the students successfully completed the courses with grades of A, B, or C. Lastly, participants varied

regarding their preference for mathematics. These results support compressed developmental math modalities.

The purpose of this research was to determine relationships between Kolb's learning styles and academic achievement in compressed developmental education modalities of math. The findings provide important knowledge of developmental education modalities in a Florida college. This research provides a small scope of the effects that Senate Bill 1720 has produced to both students and institutions of higher education in Florida. It is paramount that research be continued on the many changes that Senate Bill 1720 has employed in order to help students and colleges alike in the state of Florida.

APPENDIX A: IRB APPROVAL OF EXEMPT RESEARCH



University of Central Florida Institutional Review Board
Office of Research & Commercialization
12201 Research Parkway, Suite 501
Orlando, Florida 32826-3246
Telephone: 407-823-2901 or 407-882-2276
www.research.ucf.edu/compliance/irb.html

Approval of Exempt Human Research

From: UCF Institutional Review Board #1
FWA00000351, IRB00001138
To: John Britt and Co-PI: Glenn William Lambie
Date: April 06, 2016

Dear Researcher:

On 04/06/2016, the IRB approved the following activity as human participant research that is exempt from regulation:

Type of Review: Exempt Determination
Project Title: A CORRELATIONAL STUDY OF EMERGING MODALITIES OF DEVELOPMENTAL EDUCATION AND LEARNING STYLES IN A FLORIDA STATE COLLEGE
Investigator: John Britt
IRB Number: SBE-16-12186
Funding Agency:
Grant Title:
Research ID: N/A

This determination applies only to the activities described in the IRB submission and does not apply should any changes be made. If changes are made and there are questions about whether these changes affect the exempt status of the human research, please contact the IRB. When you have completed your research, please submit a Study Closure request in iRIS so that IRB records will be accurate.

In the conduct of this research, you are responsible to follow the requirements of the [Investigator Manual](#).

On behalf of Sophia Dziegielewski, Ph.D., L.C.S.W., UCF IRB Chair, this letter is signed by:

Signature applied by Joanne Muratori on 04/06/2016 02:56:11 PM EDT

IRB Manager

APPENDIX B: KOLB LEARNING STYLE INVENTORY

LEARNING-STYLE INVENTORY

The Learning-Style Inventory describes the way you learn and how you deal with ideas and day-to-day situations in your life. Below are 12 sentences with a choice of endings. Rank the endings for each sentence according to how well you think each one fits with how you would go about learning something. Try to recall some recent situations where you had to learn something new, perhaps in your job or at school. Then, using the spaces provided, rank a "4" for the sentence ending that describes how you learn best, down to a "1" for the sentence ending that seems least like the way you learn. Be sure to rank all the endings for each sentence unit. Please do not make ties.

Example of completed sentence set:

1. When I learn: 2 I am happy. 1 I am fast. 3 I am logical. 4 I am careful.

Remember: 4 = most like you 3 = second most like you 2 = third most like you 1 = least like you

	A	B	C	D
1. When I learn:	___ I like to deal with my feelings.	___ I like to think about ideas.	___ I like to be doing things.	___ I like to watch and listen.
2. I learn best when:	___ I listen and watch carefully.	___ I rely on logical thinking.	___ I trust my hunches and feelings.	___ I work hard to get things done.
3. When I am learning:	___ I tend to reason things out.	___ I am responsible about things.	___ I am quiet and reserved.	___ I have strong feelings and reactions.
4. I learn by:	___ feeling.	___ doing.	___ watching.	___ thinking.
5. When I learn:	___ I am open to new experiences.	___ I look at all sides of issues.	___ I like to analyze things, break them down into their parts.	___ I like to try things out.
6. When I am learning:	___ I am an observing person.	___ I am an active person.	___ I am an intuitive person.	___ I am a logical person.
7. I learn best from:	___ observation.	___ personal relationships.	___ rational theories.	___ a chance to try out and practice.
8. When I learn:	___ I like to see results from my work.	___ I like ideas and theories.	___ I take my time before acting.	___ I feel personally involved in things.
9. I learn best when:	___ I rely on my observations.	___ I rely on my feelings.	___ I can try things out for myself.	___ I rely on my ideas.
10. When I am learning:	___ I am a reserved person.	___ I am an accepting person.	___ I am a responsible person.	___ I am a rational person.
11. When I learn:	___ I get involved.	___ I like to observe.	___ I evaluate things.	___ I like to be active.
12. I learn best when:	___ I analyze ideas.	___ I am receptive and open-minded.	___ I am careful.	___ I am practical.

MCB200C

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APPENDIX C: PERMISSION TO ADMINISTER KOLB LSI

Hi John,

Congratulations! Your LSI research has been approved! Attached you will find the following documents:

- MCB200C - This is a copy of the LSI 3.1 test. You may print of copy this as needed for your research.
- MCB200D - The profile sheet contains the answer key for the test as well as the profiling graphs for plotting scores. This document may be produced as necessary for your research. The AC-CE score on the Learning Style Type Grid is obtained by subtracting the CE score from the AC score. Similarly, the AE-RO score is AE minus RO.

These files are for your data collection only. This permission does not extend to include a copy of the files in your research paper. It should be sufficient to source it.

We wish you luck with your research and look forward to hearing about your findings. Please send a completed copy of your research to Joe.McDonald@haygroup.com or you can mail a hardcopy to:

LSI Research Contracts
c/o Joe McDonald
Hay Group, Inc.
[399 Boylston Street](#)
[4th Floor, Suite 400](#)
[Boston, MA 02116](#)

Please let me know if you have any questions.

Kind regards,

Joe

APPENDIX D: RESEARCHER-CONSTRUCTED SURVEY

What is your Valencia ID number?

What developmental math course are you currently enrolled in?

- MAT 0022C
- MAT 0028C

What is your age?

- 18-25
- 25-35
- 35-45
- 45-55
- 55 or older

What is your race/ethnicity?

- White or Caucasian
- Black or African American
- Hispanic or Latino
- Native American or American Indian
- Asian/Pacific Islander
- Other

Are you the first in your family to attend college?

- Yes
- No

What were your perceptions of math before taking this course?

- Extremely Liked
- Somewhat Liked
- Neutral
- Somewhat Disliked
- Extremely Disliked

Did you like the format the course was offered in?

<https://login.qualtrics.com/ControlPanel/Ajax.php?action=GetSurveyPrintPreview>

1/2

3/21/2016

Qualtrics Survey Software

- Yes
- No

Do you feel the the course format fit your learning style?

- Yes
- No

Do you feel this course has helped you prepare for college level math?

- Yes
- No

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