

THE IMPACT OF THE DEGREE OF STANDARDIZATION AND STRATIFICATION
ON STUDENT ACHIEVEMENT, EQUITY, AND ACCESS

by

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I would like to express my deepest gratitude for achieving my Ph.D.

I dedicate this dissertation to my loving family. My parents, Anthony M. and Marjorie B. HERNANDEZ, began my educational journey by providing me with access to the higher education system through their advocacy, encouragement, and financial support. Without them, I would not have been afforded the education and career opportunities that have brought me to this point.

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Jennifer Ann Hernandez

ABSTRACT

THE IMPACT OF THE DEGREE OF STANDARDIZATION AND STRATIFICATION ON STUDENT ACHIEVEMENT, EQUITY, AND ACCESS

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Adviser: David Strubler, Ph.D.

Over the past several decades advancements in technology have created a global economy, influenced by political trends. Globalization has increased the demand for higher skilled workers, intensifying competition in the labor market. In 2018, 79 countries representing about 90% of the global economy participated in the The Programme for International Student Assessment (PISA) to understand performance differences and promote collaboration on education issues.

This study used a mixed methodology approach to examine the impact of the degree of standardization and stratification on student achievement, equity and access. The study used international comparative data to identify key indicators of a highly standardized and stratified education system to develop a survey that was distributed to Career and Technical Education teachers and administrators across the state of Michigan. In addition, 5 CTE teachers were interviewed using a presentation of the findings.

The data analysis showed that the more selection criteria used to select students for CTE the higher one can predict levels of adherence to standards. Additionally, for every unit increase in math achievement increase, access increased by 2 units. These findings support the argument that access to CTE is mediated by the selection criteria, thus controlling the access

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LIST OF ABBREVIATIONS

PISA	Programme for International Students Assessment
U.S.	United States
COVID 19	Corona Virus Disease 2019
CTE	Career and Technical Education
CCSS	Common State Standards
OCTE	Office of Career and Technical Education
OVAE	Office of Vocational and Adult Education
LEA	Local Educational Agency
PSA	Public School Academy
EDP	Educational Development Plan
OECD	Organisational for Economic Cooperation and Development
ACTE.	Advance Career and Technical Education
STEM	Science, Technology, Engineering, and Mathematics
TIMSS	Trends in International Mathematics and Science Study
UNDP	United Nations Development Data
HDI	Human Development Index
ESCS	Economic, Social, and Cultural Status
CBEEE	Curriculum-based External Exit Examinations
IAEP	International Assessment of Educational Progress
IALS	The International Adult Literacy Survey
MISD	Macomb Intermediate School District

LIST OF ABBREVIATIONS—Continued

Wayne RESA	Wayne County Regional Education Service Agency
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CHAPTER ONE

INTRODUCTION

Thirty years ago, most Americans had not heard of many of the countries in global economy today. The number of countries and economies participating in the Programme for International Student Assessment (PISA) has steadily increased from 43 during the first administration in 2000-2003 to 79 in the most recent administration in 2018 (see Appendix A). PISA is a triennial survey given to 15-year-old students around the world to assess the extent to which they have acquired key knowledge and skills essential for active participation in social and economic life. PISA accesses the core academic subjects of reading, mathematics, and science to determine the level students can extrapolate knowledge and skills and apply them in unfamiliar contexts (OECD, 2020). The countries participating in the PISA collectively represent over 90 % of the global economy, underscoring the importance of their impact on international trade and the job market. This interconnection supports the claim that one in five United States (U.S.) jobs is tied to exports, emphasizing the role of education in preparing a global workforce (Schwab, 2010).

In 2011, President Barack Obama instituted the National Export Initiative, supporting over 2 million jobs for U.S. workers, which added to the 10 million Americans who already were working in industries tied to exports (Schwab, 2010). Buchmann & Hannum (2001) refer to global forces such as policies, special interests, and Western ideology that have created a macro-structure demand for education, shaping

stratification into the labor market. The macro-structure has spread across nation-states' economic and political boundaries, creating a 'global political culture' focused on school organization and curricular content. At the same time, international corporations' employment demands have reinforced labor market inequities, which in turn has diverted subgroups away from higher education attainment (Clark, 1992).

As a result of globalization, nearly 400 million people from around the world have moved out of poverty, more than any other time in history. Education is the vehicle that not only uplifts a country's economy but also uplifts the people in their pursuit of happiness, a constitutional right afforded to all Americans. "The principle that every person has a fair chance to improve his or her life, whatever his or her circumstances, lies at the heart of democratic political and economic institutions" (OECD, p. 2019). The COVID-19 pandemic exacerbated the inequities that have long plagued our education system, renewing the focus on accelerated learning and educating the whole child to address the needs of those who are most in need.

The idea of equity is rooted in a country's social institutions. Therefore, a country's education system must reflect the same high academic standards for all students (Li, Loyalka, Rozelle & Wu, 2017; Ayalon & Gamoran, 2000; Han, 2014). Equity in education means providing each student with access to the necessary resources and support they need to succeed in school and in life. Equity aims to address disparities by creating fair learning environments and opportunities for all students. Stewart (p. 6, 2012) stated, "Getting education right gives a country a powerful platform on which to build a healthy economy and a healthy society. Getting it wrong can hold back a country for

years to come, especially in this new borderless knowledge economy, where human capital is the greatest asset most countries have.” For the U.S. to compete in the global market, our schools must have rigorous academic standards with post-secondary programs tied to industry demands (Tyson & Roksa, 2016; Levels, van der Veldon & Di Stasio, 2014). This dissertation will explore the degree to which school districts in Michigan have standardized and stratified their Career and Technical Education (CTE) programs and the impact it may have on student achievement.

Background

Globalization

Technological advancements have made it possible for people from all over the world to connect, creating borderless knowledge economies. In writing about international models of educational excellence, Stewart (2010) stated, “Technological, economic, and political trends have increased the demand for higher skills and reduced the demand for lower skills while intensifying the competition for quality jobs.” (Stewart, 2010, p.28). The global economy opens the door for international influence on our nation's systems, like health care and education, expanding our view of how the world works. This international influence is known as globalization. According to IGI Global (2018),

Globalization is the worldwide movement toward economic, financial, trade, and communications integration. Globalization implies the opening of local and nationalistic perspectives to a broader outlook of an interconnected and

interdependent world with free transfer of capital, goods, and services across national frontiers.

The demand for higher-skilled workers has also created a demand for a world-class education system. The international collaboration on education has resulted in academic standards and benchmarks to improve performance across various sectors, ensuring consistency and quality in curriculum and instruction. Standards and benchmarks aid in identifying best instructional practices and set transparent expectations for achievement. (Sahlberg, 2006; Li et al., 2017; Stewart, 2010).

School systems across the world must now prepare their students for jobs that have yet to be created. In doing so, some countries have expanded their k-12 education to rural areas where people either had no access or limited access to a formal education system. These rural areas are home to disadvantaged populations in countries like China and Singapore. By increasing access to their formal education systems, these countries have improved student performance, which has dramatically impacted their overall achievement (Sahlberg, 2006; OECD, 2012; Stewart, 2010).

Another population that countries are addressing is second language learners. The U.S. is home to immigrants from all over the world and has long been known for its diverse population. Homogeneous populations in most industrialized countries are a thing of the past because immigration has occurred on a global scale. For example, Finland has a sizable homogenous population but has seen an influx of immigrants primarily due to its advancement into the telecommunications industry. Finland is home to Nokia, one of the largest mobile phone manufacturers, with increased sales worldwide. In order to

market products and provide customer service, Nokia employs multilingual employees of diverse cultures. Many countries have experienced an increase in the number of second language learners in their k-12 education systems. If the U.S. wants to be competitive in the global economy, then our education system must prepare all students (OECD, 2012, 2018; Ornstein, Pajak & Ornstein, 2011; Sahlberg, 2006; Stewart, 2010).

The Michigan Department of Education describes how globalization has impacted the labor market, which in turn has placed higher expectations on our education system (Michigan Career Development Model, 2018, p. 5).

Massive changes taking place in all areas of employment in America present new challenges to those seeking productive careers. The impact of rapidly changing technology and an expanding global economy is being felt across all career areas and all levels of education. Employers have expectations for well-prepared, motivated employees possessing academic skills in mathematics, communications, and science. People who possess soft skills such as a good work ethic, teamwork skills, problem-solving skills, critical thinking skills, technological literacy, and a desire for continued learning are in high demand. No longer can people graduating from one of Michigan's high schools, colleges, or universities be assured of commensurate employment unless they have the necessary knowledge and skills to meet an employer's needs.

In order for U.S. industries to remain competitive, students must reach high academic levels, and our education system must align with the demands of the global economy (Allmendinger, 1989; Sahlberg, 2006; Levels et al., 2014).

Standardization

According to the American Institute for Research (2024), national curriculum standards “provide a framework for teachers, administrators, and policymakers in designing and selecting curricula, allocating instructional resources, and assessing student achievement and progress.” The CCSS used at the local level, are guidelines that outline what students in K-12 should know English language arts and mathematics by the end of each grade level. The standards aim to provide consistency across states and prepare students for college and the workforce. The CCSS offers students, families, and communities’ transparency of the expectations for learning. When all stakeholders work together toward common learning goals, districts can ensure that students make adequate progress each year (IES, 2012).

Drawing on the data of high-performing education systems around the world, the United States adopted the CCSS with the goal of raising student achievement. The National Governors Association and the Council of Chief State School Officers introduced the standards as concise skills at each grade level, giving greater focus to the content, and allowing more time for mastery of concepts. The CCSS established consistent learning expectations across the states. By focusing on these key concepts, allowing for deeper understanding through dedicated learning time, students are better prepared for their futures (Common Core State Standards, 2010; Tyson & Roksa, 2016; Drew & Thomas, 2017).

Over the past 10 years, America has been on a journey to increase the standardization of education. However, the journey has not been easy for lawmakers,

educators, and the community. Since U.S. schools have local control, they are able to write and adopt standards to meet their state's education goals. There has been much controversy over the role the CCSS plays at the state and district levels since its release in 2010. To date, Virginia, Texas, Alaska, and Nebraska have never adopted the CCSS, and Arizona, Oklahoma, Indiana, and South Carolina have withdrawn from their initial adoption. Some local districts have embraced the standards more than others, creating various levels of implementation and interpretation of the use of the standards. (Drew & Thomas, 2017; Thacker et al., 2018; Holmes & Hwang, 2016; IES, 2012).

When Michigan adopted the CCSS, the Office of Career and Technical Education (OCTE) integrated them into the National Career Cluster standards. The U.S. Department of Education Office of Vocational and Adult Education (OVAE) identified 16 career clusters representing 79 career pathways for the 21st-century economy. OVAE released the National Career Clusters in 2008. These clusters support opportunities for students in K-12 to explore a wide range of career opportunities in their pursuit of post-secondary education. The Carl D. Perkins Career and Technical Education Act of 2006, also known as Perkins IV, requires states

to adopt at least one program of study that incorporates secondary education and postsecondary education elements includes coherent and rigorous content aligned with challenging academic standards and relevant career and technical content in a coordinated, non-duplicative progression of courses that align secondary to postsecondary education; may include opportunity for secondary education students to gain postsecondary education credits through dual or concurrent

enrollment programs or other means; and leads to an industry-recognized credential or certificate at the postsecondary level or an associate or baccalaureate degree.

When the national and state governments want to standardize aspects of the education system, legislation is the vehicle used. Legislation plays a key role in identifying the minimum standard of implementation for states and local districts. Legislation tied to federal and state funding means districts have little choice in whether or not to implement the standards. States and districts must decide how and to what degree they will implement the standards.

Implementation variations include factors like adherence to the prescribed standards, quality of instructional delivery, and student engagement. Understanding implementation variations helps assess the effectiveness and integrity of a school's implementation but also makes it difficult to determine the impact standards have on student achievement. Some schools have altered course content only to include skills needed to meet the standards. Many have prioritized the standards, implementing those with the most significant impact on achievement, known as the power standards. Others have created competencies with the standards to integrate them into project-based learning. And some districts have implemented the grade level standards one grade below in an effort to increase student achievement. Whichever way districts have chosen to implement the standards, it has impacted student achievement in some way. (Ayalon & Gamoran, 2000; Han, 2014; Drew et al., 2017; Thacker et al., 2018).

Curriculum standards have also impacted local and state assessments. Districts have selected local assessments aligned to the standards to monitor students' progress and prepare them for high-stakes assessments. Some districts have used standards-based assessments for end-of-course exams, exit exams and exams for testing out of courses. Some states have encouraged school districts to buy into particular assessments by offering grants to subsidize the cost. Standards-based assessments are another way of increasing standardization in schools. (Monett, 2011; Levels et al., 2014; Holmes & Hwang, 2016; Bishop, 1997).

National curriculum standards have also impacted the process by which teachers grade students. Many districts have transitioned to a standards-based report card to ensure students have met all grade level standards. A standards-based report card is a detailed report that measures how well a student is meeting the learning standards. It provides information about what a student knows and can do in each subject. Standards-based report cards provide more transparency and consistency among teachers than traditional report cards because all students are evaluated on the same grade level skills. (Holmes & Hwang, 2016; Bishop 1997; Drew & Thomas, 2017)

Classroom teachers have used standards to create rubrics to grade students on individual or clusters of standards. While rubrics require an initial investment of time to design, teachers can use the same rubric year after year. Rubrics offer a quick and consistent way to provide students with applicable feedback. Parents also benefit from the use of rubrics because they can see exactly which standards their children have

learned, those they need to improve on, and those that have yet to be learned (Holmes & Hwang, 2016; Bishop, 1997; Drew & Thomas, 2017).

Research suggests there is a relationship between the degree of standardization and student achievement. Education systems that adhere consistently to a high level of standardization are known to have high academic achievement. High academic standards provide a level of transparency because they are clear and concise. Finally, there must be alignment of the standards-based assessments to the curriculum standards in order for students to perform well on the assessments. Because the assessments are aligned to the curriculum, teachers can use the assessment data to inform instruction. Teacher performance evaluations use student achievement data as a measure of teacher effectiveness, therefore teachers have a vested interest in teaching the standards. When schools consistently use academic standards, all stakeholders know the expectations and can work towards them. (Ayalon & Gamoran, 2000; Aylaon & Livneh, 2012; Bishop, 1997; Han, 2015; Kerckhoff, 2001; Monett, 2011).

Stratification

Stratification refers to the process of tracking students into coursework and programs. Tracking begins after the elementary years as students move into middle school. High schools typically track students into many different programs that are ranked higher and lower. For example, most students are tracked into the general education program, while other students are tracked into honors, Advanced Placement, and International Baccalaureate programs. Schools also track students into vocational training programs such as CTE.

In 2018, several bills passed in the Michigan legislature that required the state to provide Local Educational Agencies (LEAs) and Public School Academies (PSAs) guidance on career education and defined specific requirements for developing and revising Educational Development Plans (EDPs) with students. The Revised School Code (MCL 380.1166a) (1) states,

Not later than January 1, 2019, the department, in consultation with the Department of Talent and Economic Development, shall develop or adopt, and make available to schools, a model program of instruction in career development that will meet at least all of the following: a) defines learning targets and themes for each grade level, b) includes instruction for pupils in grades K to 12, c) incorporates career development education embedded within core instruction; d) includes strategies for engaging parents and community business and industry interests. In response to the Revised School Code, the Department of Education published the Michigan Career Development Model in 2018, which provided a broad overview to assist schools in developing and implementing a career development program for K-12.

This piece of legislation has the potential to track students into secondary programs. Various programs offered at the secondary level give students the ability to make choices based on their skills and career interests. The purpose of the Career Development model is to expose students to a variety of careers so they have a better idea of a course of study they would like to pursue at the secondary level (Advanced CTE, 2017, 20201, 2022). The preparation for tracking using the Career Development model

has the potential to begin as early as kindergarten (Michigan Office of Career and Technical Education, 2020).

The legislation further states that starting in the 2019-2020 school year, LEAs and PSAs “must incorporate career development education once per grade level (i.e., at least once during elementary school, middle school, and high school).” Unfortunately, this does not provide enough career education to develop student interests. Nor can students get enough knowledge about specific careers to inform their secondary course of study. Research shows that early tracking of students is associated with high academic achievement, especially when students have a high interest in what they are learning (Allmendinger, 1989).

Once students reach middle school, they can enroll in pre-vocational programs if they are available at their schools. These programs introduce students to several career pathways while providing hands-on experiences in a lab setting. Pre-vocational programs also introduce skills needed to enter the workforce and serve as a foundation for learning more complex vocational skills. Industry leaders value the fundamental abilities of employees to follow instructions or directives from supervisors, complete tasks independently to meet deadlines, and the ability to work collaboratively with others. Pre-vocational programs also continue to develop students’ EDPs, post-secondary education plans, and work goals. Students who complete pre-vocational programs have several options for their high school course selections. Pre-vocational programs are not a prerequisite for CTE; instead, they provide students with information and experiences to

help students determine if CTE is a path that they are interested in pursuing in high school (Michigan Office of Career and Technical Education, 2020)

Besides pre-vocational programs, districts use a variety of tools to attract students to their CTE programs. As part of the transition activities moving from middle school to high school, counselors, teachers, and administrators of CTE share information with students and their families to inform them of the programs offered. CTE programs publish brochures and flyers to distribute to students and hold orientations to attract students to the program. However, the information shared does not always reach all students and their families.

In fact, many students were not aware of the CTE offerings at their high school prior to enrolling. Some students took CTE courses as electives because it was the only class that would fit into their schedule. These two examples illustrate the lack of a clear process for enrolling students in secondary programs (Advanced CTE, 2017). CTE programs are considered valuable by many districts because they help students explore and refine their career interests, even if they do not enjoy the courses in which they enrolled. Some districts require CTE coursework for all students to gain exposure to various career pathways, which can aid in making informed decisions about their future (Romeo Public Schools, 2022).

Another aspect of tracking students into programs is the enrollment process itself. Just because students are interested in a specific CTE program does not mean they will be able to access the program. Many districts have an application process that takes into account some of the following criteria: prerequisite coursework, placement tests, prior

academic performance, teacher recommendation, parent endorsement, and family members of current or past CTE students. The enrollment process is in place due to the limited capacity of the programs. Pre-vocational programs and enrollment processes are key factors in tracking students into CTE programs (Kim et al., 2021).

Equity in Education

Research suggests that in highly standardized education systems, inequalities and achievement gaps are reduced due to centralized control and fidelity measures that promote a more level playing field. According to the Organisation for Economic Cooperation and Development (OECD, 2014), educational equity is contingent upon fairness and inclusion. Fairness suggests that one's personal conditions should not limit the potential for academic success. Inclusion suggests comprehensive standards apply to everyone in the education system. The level of education one obtains within an educational system is directly correlated to one's quality of life and future wealth. Thus, the underlying belief that education can uplift those in poverty is accurate (Green et al., 2015; Ayalon & Gamoran, 2000; Levels et al., 2014). Centralized control ensures that educational quality is maintained across a system (Ayalon & Livneh, 2013; Ayalon & Gamoran, 2000; Green et al., 2015).

In 2018 (p. 13), the OECD wrote,

Equity in education means that all schools and education systems provide equal learning opportunities to all students. As a result, students of different socio-economic status, gender, or immigrant and family backgrounds achieve similar levels of academic performance in key cognitive domains, such as reading,

mathematics, and science, and similar levels of social and emotional well-being in areas such as life satisfaction, self-confidence, and social integration, during their education. Equity does not mean that all students obtain equal education outcomes; rather, differences in students' outcomes are unrelated to their background or to economic and social circumstances over which the students have no control. Equity in education also demands that students from different backgrounds are equally likely to earn desirable post-secondary education credentials, such as university degrees, that will make it easier for them to succeed in the labour market and to realise their goals as adult members of society.

Levinson et al., 2022 argues that 'equal learning opportunities... not... equal learning outcomes'(p. 3) is what the OECD is referencing. Providing an equal distribution of instruction, materials, resources, and programs is the concept of standardization, as previously described. The OECD goes on to say equity does not mean that all students obtain equal education outcomes but that they 'achieve similar levels of performance. However, many researchers may argue that performance levels and outcomes are the same concepts. These statements demonstrate that equity applies to various aspects of education. Levinson et al., 2022 identified five meanings of equity that are currently in use in education: equal distributions of outcomes across populations; equal outcomes for every child; equal resource allocations across students, schools, districts, states, or nations; equal experiences for each child; and equal levels of growth

by each child. All aspects of equity are important to educators, and school districts should be mindful of how they apply in practice.

Definitions

The OECD is an international organization that works to establish evidence-based international standards and build better policies for better lives. Membership to the OECD includes developed countries and independent economies. For this dissertation, the term country is inclusive of the countries and economies that are members of the OECD.

The OECD (2020) defines horizontal stratification, also referred to as tracking, as “how students are grouped and selected into different curricular programmes and ability groups” (p. 40). In some systems, students choose their programs, and in other systems, it is based on academic criteria. The two types of programs are those that focus on general skills required for post-secondary education and vocational or technical programs, which focus on practical skills aligned with the labor market.

The OECD (2020) defines vertical stratification as the structure of instructional grade levels and programs that students are required to complete for graduation. The OECD (2020) defines ability grouping in schools as “placing students into different classrooms or in small instructional groups in a class based on their initial achievement or skill levels” (2020, p. 75).

Allmendinger’s (1989) standardization-stratification framework defines a standardized education system as the degree to which the quality of education meets the

same standards nationwide. The framework identifies a national curriculum, national examinations, and standardized school resources as key features of the framework.

Allmendinger's (1989) framework defines stratification as the degree to which education systems have specific schools whose curricula are ranked as higher and lower. Allmendinger identified stratified systems as having some type of tracking or grouping of students between secondary schools and providing more diverse vocational programs for streaming students.

As previously stated, equity has many aspects that need consideration in CTE programs. Equity means providing all students with what they need to reach their educational goals and to aspire to their greatest potential. For this dissertation, the focus will be on the equal distributions of outcomes across populations as defined by the Perkins V indicators and SAT data. Equal resource allocations are defined as the pathways offered and those in which students participate. Equal experiences are defined by the access to credentials and credentials earned by students.

Career and Technical Education programs are defined as those approved by the Michigan Department of Education Office of Career and Technical Education (OCTE). All state-approved CTE programs are evaluated by the Perkins V indicators: four-year graduation rate, academic proficiency in Reading Language Arts, academic proficiency in Mathematics, academic proficiency in Science (optional), post-program placement, nontraditional program concentration, and program quality. Perkins V indicators align with the CTE program standards. CTE programs are organized into 27 Perkins regions

and 53 Career and Education Planning Districts. This regional structure provides students with access to state-approved CTE programs throughout Michigan. Programs for secondary students are available through area career centers, intermediate school districts, public school academies, and local education agencies.

Theoretical Framework

Political Theory of Justice

Education systems are grounded in a country's political system. Education is regulated and funded by federal, state, and local governments, which makes it part of the overall political system. At the local level of government in the United States, boards of education oversee the operations of school districts. During official elections, members of school boards are elected by the residents of the community in which the school district resides. Since education systems are social institutions within a political system, political theories underlie their rules and practices.

In a democratic society, social institutions must honor the rights of people afforded to them under the constitution. In doing so, social institutions are administering social justice to the people they employ and the community they serve. Federal governments in a democratic society, social institutions must honor the rights of people afforded to them under the constitution. In doing so, social institutions are administering social justice to the people they employ and the community they serve. Federal governments have laws in place to protect the rights of people within social institutions. In turn, social institutions must obey these laws that protect the rights of all people. Federal laws secure the rights of people within a social institution and are not subject to

political bargaining (Rawls, 1999, 2001). In order to examine and evaluate equity in the context of education, one must view it through a political lens using a political theory of justice and equity (Rawls, 1999, 2001). Therefore, it is appropriate for this dissertation to use the Social Justice Theory, Critical Race Theory, and Access Theory as a framework because they are grounded in political theories of justice.

Laws of People: The Basic Structure

Rawls (1999) refers to a realistic utopia, which he calls the “Law of Peoples.” A realistic utopia assumes that people are decent and fair within society and follow the agreed-upon social contract, which is also fair. The realistic utopia also takes into account that all people have equal basic liberties, and it is within human nature and moral consciousness for social institutions to honor and uphold these liberties. The utopia also recognizes that the distribution of goods produced is based on a fair system, regardless of what the system may be. Using a utopian lens, one can describe the basic structure and understand how society works together for the good of all.

A political society is a fair system of cooperation from one generation to the next. The only way to enter society is through birth, and the only way to leave is by death. Therefore, within society, one will lead a complete life. Even in a well-ordered society, inequalities exist that impact one’s pursuit of life’s prospects. Rawls (2001) identifies three inequalities called contingencies: the social class one is born into, native endowments and opportunities to develop these endowments, and good and ill fortune over the course of a life. These contingencies inform what one can realistically expect in

terms of life's opportunities. One can then assess the opportunities afforded to them to determine one's future within the society. Based on this assessment, one can pursue life with confidence and vigor or with skepticism and lethargy.

“Society cannot simply “ignore the inequalities that come from the contingencies while failing to institute the regulation necessary to preserve background justice.” In doing so, society “would not be taking seriously the ideas of society as a fair system of cooperation between citizens as free and equal” (Rawls, 2001, p. 56). On the other hand, society must rely on some inequalities to be well-designed and effectively organized. Therefore, it takes people from a variety of educational backgrounds, skill levels, and social classes to make the system work. Everyone's contribution to society, no matter how great or small it may be, is important for it to endure.

To say members of society are free and equal citizens participating in a fair system of cooperation, one must examine how political or procedural justice regulates social institutions to create a fair and complex structure of cooperation. In order for members of society to be free and equal, there must be rules of cooperation that are publicly known and honor the claims specified in the rules. The goods that result from the cooperating system must be distributed in an acceptable and just manner. One must use the utopian lens to understand how this translates to society as fair and just. In doing so, the rules of cooperation are publicly known in the laws of society, the judicial system honors claims made by all members, and the distribution of goods is certainly not unfair, even though it may be flawed. Most of society would agree that the cooperating system is generally fair.

The rules, as part of procedural justice, specify a system of cooperation designed to advance the good of all participating in it. Society is then a cooperative endeavor for mutual advantage. Cooperation in a society provides the possibility of a better life for all than they would have if each member were to live solely by one's own efforts.

Cooperation creates mutual interest, but there is also conflict that comes from how the benefits produced by cooperation are distributed. In order for members to pursue the means to the end, they must believe their share is fair and just, even though some receive a larger or smaller share than others. "A set of principles is required to determine distributive shares. These principles are the principles of social justice: they provide a way of assigning rights and duties in the basic institutions of society, and they define the appropriate distribution of the benefits and burdens of social cooperation" (Rawls, 1999, p. 4).

Society is a self-sufficient association of people who, in their relations to one another, acknowledge specific rules or laws of conduct as binding and act in accordance with them. The basic structure of society must continue over time to regulate what is required to maintain background justice in the social institutions equally for all members regardless of demographic features such as social class, age, gender, and race. As procedural justice is followed, it allows members to proceed with the complexities of daily life and frees them from having to keep track of the fluctuating positions of individuals.

In summary, Rawls (1999, p. 57) states,

This structure (the basic structure) comprises social institutions within which human beings may develop their moral powers and become fully cooperating background justice over time from one generation to the next, it realized the idea of pure background procedural justice as an ideal social process. It also answers to the public role of educating citizens to a conception of themselves as free and members of a society of free and equal citizens. As a framework that preserves equal. When properly regulated, it encourages an attitude of optimism and confidence in their future and a sense of being treated fairly in view of public principles, which are seen as effectively regulating economic and social inequalities.

A Theory of Justice

In Rawl's Theory of Justice (1999), he proposes two principles of justice. The first is the idea that each person has the same infeasible claim to a scheme of equal basic liberties, which is compatible with the same scheme of liberties for all. The second idea is that social and economic inequalities should satisfy two conditions: first, they are to be attached to offices and positions open to all under conditions of fair equality of opportunity, and second, they are to be to the greatest benefit of the least advantaged member of society. These principles are applied in four stages.

The first stage is the adoption of the principles behind a veil of ignorance. "A veil of ignorance means no one is advantaged or disadvantaged in the choice of principles by the outcome of natural chance or the contingency of social circumstances" (Rawls, 1999,

p. 11). The second stage is the constitutional convention, which is the way the principles of the constitution work in practice. The first principle applies to the second stage; all people have the same claim to the same basic equal liberties as the constitution allows. The third stage is the legislative, in which laws are enacted as the constitution allows and as the principles of justice require and permit in accordance with social and economic legislation. The second principle to the third stage: laws are enacted to ensure economic inequalities are to satisfy two conditions: first, they are to be attached to offices and positions open to all people under conditions of fair equality of opportunity, and second, laws enacted as the constitution allows are to be to the greatest benefit of the least advantaged member of society. The final stage requires rules to be applied by administrators and followed by citizens. The constitution and the laws are interpreted by members of the judiciary, who give citizens complete access to all of the facts.

The first principle details one system of equal basic liberties for all people, which is the same system and the same equal basic liberties for all people. The principle further clarifies that all people have the same claim to that one system and the same basic liberties within it, including the same fair chance for all people to attain equal basic liberties. “Equal basic liberties include freedom of thought and liberty of conscience, political liberties (right to vote and participate in politics), freedom of association, as well as the rights and liberties specified by the liberty and integrity of the person and finally the rights and liberties covered by the rule of law” (Rawls, 2001, p. 44). For example, people who have similar talents, abilities, and willingness to use these basic equal liberties should have similar prospects of success. Regardless of their social class of

origin, the class into which they are born and develop until the age of reason. In society as a whole, there are to be similar cultural and achievement prospects for those similarly motivated and natively endowed.

The question one may ask is how a society decides if this principle is realized by its members. Society accounts for differences by applying a principle of distributive justice at particular intervals of time to social institutions. The Difference Principle requires that the difference in income and wealth earned from producing society's goods be such that if the share of the more advantaged is more, then the share of the less advantaged is also more. Furthermore, if the share of the most advantages is less, then the share of the least advantaged is less. The degree of inequalities in income and wealth and the degree to which people are willing to work to earn a greater share must contribute effectively to benefit the least advantaged.

A society's income and wealth are contingent on the type of work people do and how hard people work for their share or a greater share. People decide for themselves how hard they will work and how they will lead their lives based on the incentives society offers. The degree of inequalities must benefit all. For example, the only way to justify the inequalities between men and women is if women are better off than they were before and they view themselves as being better off than they were before. Rawls further clarifies that historically, unequal basic rights and opportunities founded on race arose from inequalities of political power and control of resources. They were never to the advantage of the least favored. Therefore, acknowledging those inequalities as a violation of the basic liberties afforded to all.

Social and economic inequalities must satisfy two conditions. First, they must be attached to offices and positions that are open to all citizens under the conditions of equal opportunity. Second, they must be to the greatest benefit of the least advantaged member of society, which was stated above as the difference principle. Therefore, society must set up a free-market enterprise within political and legal institutions that prevent excessive concentrations of property, wealth, and political power. Society must also set up equal opportunities for members to access and participate in the education system. These two systems are essential to preserving background justice, like fair equality of opportunity, while ensuring economic and social inequalities contribute to equality, democracy, and the sustainability of society, which is to benefit the least advantaged.

The least advantaged are those belonging to the income class with the lowest expectations and the least amount of wealth. Society aims to find a basic structure where

The least advantaged are those belonging to the income class with the lowest expectations and the least amount of wealth. Society aims to find a basic structure where inequalities in income and wealth are to the benefit of the least advantaged. In doing so, people can pursue their basic rights and liberties as free and equal citizens. They have the freedom to pursue an array of diverse educational opportunities and occupations as a means to an end, the freedom to hold offices and positions of power, and the freedom to make choices and decisions in regard to their pursuits in life. Understanding that income and wealth can be exchanged to achieve a range of goals. These basic freedoms are the social bases of self-respect, which is essential if citizens are going to pursue life with confidence and vigor. Since society is a self-sufficient association of people who engage

in cooperation for mutual advantage, it is in their best interest, as individuals in relation to one another, to support each other in pursuing life with confidence and vigor. Self-respect as a social base acknowledges that citizens have equal basic rights, that those rights are publicly recognized, and that everyone believes in the difference principle.

Critical Race Theory

Critical Race Theory gained recent public popularity in the media as the world was in the midst of the COVID-19 pandemic, which exacerbated the inequities among disadvantaged groups based on race, ethnicity, gender, sexual orientation, and social class. The larger population, primarily whites, feared Critical Race Theory, thus failing to understand and address the social and political inequalities that exist in the United States. Conservative lawmakers demonstrated this fear when they sought to ban the instruction of Critical Race Theory and culturally diverse books in elementary and secondary schools. Many lawmakers misrepresented the theory and its importance with the goal of silencing discussions of racism, equality, social justice, and the history of race in the United States. Critical Race Theory embedded in our nation's political theory of justice is valuable in research where diversity is studied to explain the lived experiences of diverse people.

Critical Race Theory originally appeared among academic scholars of critical theory in the early 1900's. It was further developed in critical legal studies out of the Civil Rights Movement, specifically to examine the intersection of race and law in the United States. Derrick Bell, a leader in Critical Race Theory, introduced the concept of "interest convergence" in 1973 and developed the idea of "permanence of racism" in a

1992 series of essays, “Faces at The Bottom of The Well.” Richard Delgado, Jean Stefancic, and other scholars continue to work on Critical Race Theory today, expanding from the field of law and legal studies to K-12 and higher education.

Critical Race Theory is a framework used to examine social, cultural, and legal issues as they relate to racism in a broad sense. It acknowledges that racism is the result of complex, changing, and subtle social institution dynamics. Critical Race Theory pairs well with Social Justice Theory in that they both offer a more political theory of equity and address citizens' basic equal rights and liberties afforded under the Constitution of the United States of America. Critical Race Theory can help one better understand how strides made in civil rights benefited the least advantaged but were a greater advantage of the most advantaged to gain power and control of resources. Rawls states that historically, unequal basic rights and opportunities founded on race were never to the advantage of the less favored races. He further acknowledges that these inequalities were a violation of the basic liberties afforded to citizens.

Scholars continued to elaborate on critical race theory and have identified numerous tenets. This dissertation will focus on four tenets: the permanence of racism, also known as racism is ordinary; interest convergence to include idealists, realists, and materialists, also known as material determinism; and social construct thesis. Racism is ordinary, means racism does not deviate from the standard accepted in the United States. Racism is the way Americans do things; it is the way society works in America. Racism embedded in our social institutions and the experiences of everyday life goes unnoticed unless one is a person of color or another marginalized minority, including LGBTQ. All

of which makes racism, in general, difficult to address. Bell (2005, p. 309) goes as far as to say racism is an “indestructible component of this society.”

Rawls’ theory provides the clarity needed in an attempt to understand why racism continues to exist. Rawls states that in order for members of society to be free and equal, there must be rules of cooperation that are publicly known by all and honor the claims specified in the rules. When the rule of cooperation is racism, then racism becomes indestructible. Rawls’s theory acknowledges that the system is not fair, but the majority of society would agree that the cooperating system is generally fair. The majority also agrees that the system of racism is usually fair.

Racism and bias, hidden in “unofficial” practices and “neutral standards,” are ingrained in the fabric of human beings, which makes them invisible and difficult to articulate. It is the unspoken actions rather than the explicit and intentional prejudices of individuals. Those who exhibit these characteristics do not even realize their words and actions are racist and biased. Thus, the term unconscious bias. People of color often struggle internally as to whether or not an obstacle they experienced is race-related or the result of a personal shortcoming. Despite the Equal Employment Opportunity Act of 1965 and the Fair Housing Act of 1967, discrimination still exists in employment and the housing market.

The theory of justice states that inequalities are needed in order for a democratic society to exist. However, the degree of inequalities must benefit all. Inequalities can only be justified if the least advantaged are better off than they were before and the least advantaged view themselves as being better off than they were before. In the rule of

racism, the least advantaged are not better off, and they do not feel they are better off. Therefore, the inequalities that the rule of racism creates are a violation of the basic liberties afforded to all people of color and marginalized groups under our constitution (Rawls, 1999). Society cannot openly accept racism as a rule because it goes against our societal belief in fairness, which is why people are uncomfortable talking about it.

Bell (2005) discusses the temporary peaks of progress toward equality for Blacks, which are short-lived improvements that dissolve once white dominance asserts itself. A clear example is the Black Lives Matter movement overshadowed by the All Lives Matter movement, which was in direct criticism that Blacks should not matter more than whites. Laws are applied more harshly to Blacks, and police practices far too often result in the death of Blacks. The reason this inequity is accepted is that our system of white-over-color ascendancy serves important purposes, both psychic and material, for the dominant groups (Delgado & Stefancic, 2017).

The permanence of racism also includes color-blind approaches to equality that call for the same treatment across the board. These practices only remedy the most blatant forms of discrimination while continuing to undermine the existence of the real issues contributing to racism. An example is the controversy over Critical Race Theory. Whites wanted to put a stop to CRT, thus advocating that all people belong to one race and CRT only divides races. Whites used this color-blind theory approach to silence the discussion of racism, equality, and social justice.

The second tenet is interest convergence, also known as material determinism, which supports the idea that black people achieve civil rights victories only when whites

have something to gain, which is often of a political or economic nature. Additionally, “racism advances the interest of both white elites and working-class whites, large segments of society have little incentive to eradicate it” (Delgado & Stefancic, p. 9, 2017). An example is universal male suffrage. Prior to 1819, only elite whites who held property and wealth were allowed to vote. At that time, working-class whites were fighting for their right to vote and were in support of universal male suffrage. Universal male suffrage would give blacks the right to vote as well. Working-class whites bargained with elite whites for the right to vote with the stipulation that black males be denied the right to vote. Throughout history, elite whites have bargained with working-class whites by excluding black rights (Bell, 2005; Delgado & Stefancic, 2017).

Delgado and Stefancic (2017) discuss three “camps” of thought that divide CRT scholars on racism: idealists, realists, and materialists. Idealists support the idea that racism is a social construction or a mental attitude altered through discourse. People were misinformed about the black race, and through education, their minds have changed. A current example is the misinformation asserted that all migrants and immigrants are criminals, even though data shows that migrants and immigrants are less likely to commit crimes than native-born Americans. This misinformation has created fear among Americans and urgency by the federal government to deport Mexicans and Latinos.

Idealists focus on social teachings and appeal to one’s higher morals, known as white guilt. Idealists hold these beliefs because they know racism is rooted in the progress of ideas with no concrete basis. The criticism of this belief is that it does not

address the unquestioned white supremacy ingrained in society. It does not acknowledge the relationship between white privilege and racism and the profitability that results from racism, as seen today. Thus, all white people gain from racism (Gibson, 1995).

The rule of whiteness is a publicly acknowledged rule of cooperation accepted by the majority of society and recognized by all. Whites who support equal rights for Blacks use and benefit from the rule of whiteness. It is just a way of living in our society that many whites are not aware they are even benefiting in ways people of color and marginalized groups cannot. Light-skinned people will often benefit from the rule of whiteness. The more white one looks or the lighter one's skin, the more one benefits from the rule of whiteness.

Realists support the idea that racism is a means by which society allocates privilege and status. Racial hierarchies that determine who gets tangible benefits, including the best "jobs, the best schools, and invitations to parties in people's homes." (Delgado & Stefancic, p. 21, 2017). Bell (2017) supports realistic realism and states that racial equality is not a realistic goal. He further argues that once blacks accept this notion, only then can realistic goals be set to make society better. It is hard to come to terms with the fact that people of color are subordinate and must publicly acknowledge that they are subordinate. However, in doing so, one can avoid frustration, anguish, and despair. Moreover, more importantly, one can be freed up mentally to envision and pursue laws and policies that can bring about more permanent changes, which can result in a more meaningful status for blacks and others.

One system that continues to maintain the status quo is our court system. In legal studies, Bell cites the logic of precedent, “a procedural rule from a former case cannot simply be applied to a new case with a multitude of facts that vary from the former case.” (p. 74, 2017). The procedural rule only perpetuates racial bias and discrimination within our court. Bell (2017) argues that judges should be able to make decisions based on their own experience and expertise. Rulings made twenty or more years ago do not acknowledge the progress made in dispensing justice fairly, nor do they account for new knowledge and information gained from what society knows about the impact of racial inequalities on the lives of people. This example demonstrates how our systems continue to perpetuate racial bias.

Materialists support the idea that racism is historical with the rise of capitalism that aims to divide social classes and workforces. They acknowledge that racism is used to maintain social class divide and inequities to secure elite white-ism. They hold an optimistic vision of the possibility of ending racism using an integrated movement striving for democracy and equality, thus advocating that injustice to one is an injustice to all. While racism, a powerful ideological system, can be erased by obliterating the social need for racism, that is, inequality of material life (Gibson, 1995). Racism is essentially a political vehicle to demonize people in order to justify exploiting them in order to achieve a political agenda and gain public support. Therefore, “in order to understand racial progress or lack of progress, one must look at the white political landscape of America’s history” (Delgado & Stefancic, p. 21, 2017)

An example to support this materialistic idea is the *Brown v. Board of Education*. At that time, the United States was in the international spotlight. World War II had ended, and African Americans defended the country with honor. The U.S. was coming out of the Korean War, where again African Americans served their country, and was entering the Cold War. The U.S. was looking for allied nations, most of which were nations of color. Therefore, it would not have served the political agenda of the U.S. to continue racial oppression and violence at home. In 1954, the U.S. Supreme Court ruled in favor of *Brown*, which is where the white and black agenda converged. The U.S. cannot be a global leader of nations, many of which are nations of color when it rules a country that accepts racism (Bell, 2005; Delgado & Stefancic, 2017).

The third tenet of Critical Race Theory is the social construct thesis, which states that race and racism are products of social thought and relations. Not objective, inherent, or fixed, they correspond to no biological or genetic reality; rather, races are categories that society invents, manipulates, or retires when convenient. People of similar origin share certain physical traits, such as skin color, physique, and hair texture. However, there are extremely small portions of genetic endowment that have little or nothing to do with distinctly human higher-order traits such as personality, intelligence, and moral behavior. Society endows them as pseudo-permanent characteristics that are of great interest to critical race theorists. Differential racialization is how the dominant society racializes different minority groups at various times in response to shifting needs, such as the labor market.

The last tenet included here as it pertains to this dissertation is the intersection of race and law or public policies, particularly those within our education system. The intersection of race and law is the underlying issue embedded in the work of critical race theorists like Bell, Delgado, and Stefancic. These and many other great thinkers and researchers of law have paved the way for other critical theorists in numerous fields. For this dissertation to study the impact of standardization and stratification on student achievement, it must specifically study marginalized categorical subgroups in order to be inclusive of all students. If an educational program fails these students, then it is a system of failure.

A Theory of Access

Ribot and Peluso (2003) define access as the ability and the right to derive benefits from things such as materials, people, institutions, and symbols. It includes every possible way a person can derive benefits from these resources. The ability and right to benefit are distinctly different. “Ability is the capacity to affect the practices and ideas of others” through the use of power. Right refers to the claim under the law to benefit.

This definition aligns with Rawl’s (1999 & 2001) political theory that all free and equal citizens have basic rights and liberties afforded to them by the social institution that is not subject to negotiation. Ribot and Peluso acknowledge that the right is by law, custom, or convention and is not necessarily equal, acknowledging Bell’s (2005) work identifying racism as ordinary. It does not deviate from the standard accepted in the United States. It is embedded in our social institutions and goes unnoticed by most but is

acknowledged in theory. However, Rawls believes social institutions have a moral obligation to uphold the liberties afforded to people under society's laws.

Ribot and Peluso (2003) acknowledge that some illegal actions under the law maintain a socially sanctioned base of collective legitimacy. Therefore, the law can never specify all paths to access with overlapping powers of access. Rawls (1991) argues that the least advantaged may benefit, but there is a greater benefit for the most advantaged to gain power and control of resources. A theory of access conveys the idea of a 'bundle of powers' to those who control access. Rawls, Ribot, and Peluso agree that power resides in social institutions and the people within the institutions. The institutions and people within them are the gatekeepers to access, holding the bundle of powers to identify points of access and determine who benefits and who does not. Therefore, power develops from human interactions that are associated with gaining, controlling, and maintaining access (Delgado & Stefancic, 2017; Ribot & Peluso, 2023).

Ribot and Peluso (2003) refer to a process of dynamic mapping to determine the relationship of access to resources and institutions. This mapping analysis focuses on who does and does not benefit, in what ways, and when one benefits—the dynamic mapping process changes when the distribution of power to social institutions changes. Therefore, access continually changes with the changing of the guard, and so do the rights to and benefits of access. Racism and bias embedded in these processes and unspoken actions make them invisible. Bell (2005) argues that people of color and other marginalized groups struggle internally as to whether or not an obstacle they experienced

is race-related or the result of a personal shortcoming (Bell, 2005; Delgado & Stefancic, 2017). While dynamic mapping identifies the relationships of access, it does not uncover racism or bias. Therefore, it would be critical for institutions to purposefully review processes to identify and dismantle any unfair advantages based on nondiscrimination prohibitions.

Access is a political-economic web of processes in relation to human interactions that enable one to control, maintain, and gain access. Rangan (1997) describes access control as the ability to mediate the access of others using the power and processes of social institutions. Berry (1993) describes control maintenance as using power and resources to keep access open. Therefore, control access is dependent on maintenance access. Gaining access is claiming the right to access, a process that establishes access. Executing the duties of access is a form of access maintenance (Ribot & Peluso, 2023).

Table 1.0 illustrates the aspects of CTE programs for access maintenance that need to be kept open in order for access to be controlled. When access is maintained and controlled, then access can be gained.

Table 1.0

Access to CTE

Access Maintenance + Access Control = Access Gained

Access Maintenance	Access Control
Career Pathways	Grade Levels
Qualified Teachers	Recruitment Process
Courses Offered	Application Process
Equipment and Materials	Enrollment Process
Student Schedules	Scheduling Process

Table 1.0 shows five aspects of access maintenance in CTE programs. Each aspect influences one another. The availability of certified CTE teachers, teacher credentials, and the recruitment of qualified industry professionals to the teaching profession impact the number and type of career pathways and the number of courses and sections offered. Specialized and industrial-grade equipment can be costly, which impacts the career pathways offered. The number of required courses students need to take to meet the graduation requirements determines if students' schedules will allow time for CTE courses. There may be a situation where a required course and a CTE course are offered at the same time. In this situation, the student may not be able to take the CTE course. Due to the limitations of access maintenance, some students will not have an opportunity to gain access.

Table 1.0 shows five aspects of access control in CTE programs. The grade levels at which career pathways are available to students will control the number of potential students taking CTE courses. The student recruitment processes, such as the distribution of flyers, emails, assemblies, and counselors speaking with students, are controlled by the number of students who receive the communication. The application process may require students to meet a predetermined set of criteria like prerequisite coursework, assessments, or interest surveys, which determine which students qualify for CTE. The enrollment process narrows down the number of students that apply to the number of seats available, and this process clearly controls access to CTE.

While asserting one's rights to derive benefits is a form of access control, the carrying out of the duties is access maintenance. Once students gain access to CTE, they must maintain their access by studying and meeting the course standards. A division of benefits is negotiated between those who own the resources and those who labor with those resources or those who control others' access and those who maintain their access. School districts benefit from having students enrolled in CTE. The benefits could be in the form of increased enrollment, funding, community partnerships, or adherence to state or federal expectations. The negotiation of benefits may include incentives for students to enroll or exceptions to the application process, such as waiving prerequisites. This negotiation allows both parties to benefit.

“Since inequalities exist even in well-ordered societies, in fact, society relies on some inequities as a whole, one can expect the same types of inequities to exist within a

social institution” (Rawls, 1999). This dissertation will investigate the impact of the degree of standardization-stratification on student’s access to career and technical standards. Critical race theory intersects here to investigate if the inequities discovered are to the advantage of the least advantaged students, which for this research are students of color and other marginalized student groups within the education system. A review of program demographics, enrollment demographics, supports, and resources is needed to account for differences in underrepresented and underserved groups or the degree to which a color-blind approach to equality is present.

Access theory will be used to investigate if there is bias in gaining access. School districts must use distributive justice to provide equal opportunities for students to access and participate in Career and Technical Education programs. These two systems are essential to preserving background justice, like fair equality of opportunity, while ensuring economic and social inequalities contribute to equality, democracy, and the sustainability of society, which is to benefit the least advantaged.

Specific Research Question

The purpose of this study is to investigate the relationship between standardization-stratification and student achievement. Therefore, I pose the following research questions to be addressed within the context of this study:

1. What impact does the degree of standardization-stratification have on student achievement?
2. What impact does the degree of standardization-stratification have on achievement gaps among subgroups

3. What impact does the degree of standardization-stratification have on equitable access to CTE programs?
4. How have districts standardized-stratified their Career and Technical Education programs?

The first question will help determine if there is a relationship between standardization-stratification and student achievement. If there is a relationship, then what is the relationship between the degree (high, medium, or low) and student achievement? I want to identify the key aspects of the standardization-stratification model that have the greatest impact on student achievement. The second question will help determine if there is a relationship between the degree and student achievement and then what the relationship is between the degree and student achievement of subgroups. I want to explore the relationship between the degree and the achievement gaps among subgroups and non-subgroups and how it may impact access for these students. The third question will help me understand the relationship between the degree and the access that subgroups have to CTE programs. I will further explore the practices associated with equity, access, and inclusion. The fourth question will help me understand the practices used by local districts to standardize and stratify their CTE programs and their impact on student achievement and equitable access.

This study will add to the description of the standardization-stratification model, identifying indicators that have a positive impact on student achievement and promote equity and access by addressing disparities between categorical subgroup students and their non-subgroup counterparts. This study will add to the knowledge base of how CTE

system processes impact student achievement and how these systems impact student access and inclusion in CTE programs. Identifying indicators that impact student achievement would be of great importance to CTE programs because the indicators could be cross-referenced to the Perkins V indicators. This cross-reference could lead to higher student achievement and access to programs for all students. The results of this study will assist school administrators in reviewing their current practices and how they may be impacting student achievement and access to programs so they can make informed decisions about their CTE systems.

Significance

To understand the potential significance of this study, I need to refer back to the underlying theories. John Rawls's Social Justice Theory states that each person is to have an equal right to the most extensive total system of equal basic liberties compatible with a similar system of liberty for all. If society believes that each person has equal rights and is free from oppressive restrictions within our education system. Then, we must understand the oppressive restrictions and address them so all students can aspire to their greatest potential. Research suggests that the standardization-stratification model closes the achievement gap by gender, socio-economic status, and special education among industrialized countries. The potential significance would be a model that schools could use to ensure equity within their education system.

There is potential for boards of education to adopt policies in support of using the model as part of a larger equity initiative not only in CTE but in other programs as well. Districts want to implement equity initiatives but lack the knowledge and tools. The

standardization-stratification model could be a tool that they could use as part of a program evaluation or program improvement process.

The Michigan Department of Education Office of Career and Technical Education (OCTE) could add the standardization-stratification model further to support their work with non-traditional students and inclusion. Advance Career and Technical Education (ACTE) has conducted national research with an oversample of Black and Latinx families and families with low income to identify variances in message emphasis. This study could support their equity and inclusion initiative, which could change the process of districts tracking students into local CTE programs while reducing the achievement gaps for marginalized populations. The foundation of education is based on higher achievement for all students: college, career, and workforce readiness and the transition from secondary and higher education to the labor market.

Conclusion

Many studies have been conducted on the national education systems of industrialized countries. The U.S. education system is based on local control, making each state and local municipality a unique education system. No research has been found at the level of individual school districts investigating the relationship between standardization, stratification and student achievement. There has been much research on adherence to academic standards and student achievement. There has also been much research on tracking students into secondary coursework. The unique lens of my study investigates the system structure of using standards and tracking.

CHAPTER TWO

LITERATURE REVIEW

Educational attainment is a key determinant of economic success because it significantly influences job opportunities and income levels. Preparing students for college and the workforce is consequential for countries to enhance their economic success. The intent of the Program for International Student Assessment (PISA) is to understand performance differences on a global scale and promote collaboration to address the data. The data sets published by the Organisation for Economic Co-operation and Development (OECD) have been used in comparative research studies and have influenced decision-making in education policy (OECD, 2019).

This literature review presents Allmendinger's (1989) standardized-stratified framework for comparing national education systems to better understand why countries like China, Singapore, Macao (China), Hong Kong (China), and Estonia consistently outperform all other countries in reading, mathematics, and science on the PISA. Allmendinger's standardized-stratified framework identifies the extent to which national governments have prescribed and regulated academic standards coupled with tracking students into vocational programs.

For the purpose of understanding the role of the OECD, this literature review provides a historical context of how the OECD has evolved from its conception. The basis for the examination of the impact academic standards and tracking have on student achievement is formed through a review of the research findings from the standardized-

stratified framework, comparing international education systems in terms of educational performance and vocational outcomes. Findings are reported from related studies in the U.S. and internationally to discuss the implications of the dissertation.

Historical Context of the OECD

The Organisation for European Economic Cooperation (OEEC) was established in 1948 after World War II to reconstruct Europe under the Marshall Plan. The goals of the OEEC were to aid European governments in understanding their economic interdependence, allocate and distribute aid, and plan and influence a European Recovery Programme for Western European countries. In 1961, the OEEC reformed into the Organisation for Economic Co-operation and Development (OECD). Today, the OECD works internationally to shape and build policies that promote prosperity, equality, opportunity, and well-being for all. The basis for this work is to establish evidence-based education standards while finding solutions to social and economic challenges. Thus stimulating economic progress and world trade (OECD, 2020).

In the 1990s, the OECD gathered international experts and institutions to develop an assessment tool to measure what students actually know and are able to do in the core subject areas. The collaborative effort between countries resulted in the development of the Programme for International Student Assessment (PISA). In 2019, the OECD stated,

The idea behind PISA lay in testing the knowledge and skills of students directly, through a metric that was internationally agreed upon, linking that with data from students, teachers, schools, and systems to understand performance differences, and then harnessing the power of collaboration to

act on the data, both by creating shared points of reference and by leveraging peer pressure.

PISA was created by those who can influence change in education and policy nationally and internationally (OECD, 2019). When PISA was first introduced in 2000, 43 countries participated in the assessment. Participation has increased over the years, with 79 countries participating in 2018. Out of the 79 countries, 37 were OECD member countries, and 42 were partner countries (see Appendix A).

PISA is a triennial survey measuring reading, mathematics, and science attainment. The administration of the PISA is primarily online, and it takes up to two hours to complete. For schools with limited access to technology, paper-pencil assessments are available. Each subject is on a three-year rotation for detailed testing and more thorough analysis. Reading was the focus in 2018 and was administered to 600,000 15-year-old students, representing about 32 million students from around the globe. At the time of the assessment, students were between the ages of 15 years 3 months and 16 years 2 months and completed at least 6 years of formal schooling as determined by their respective school systems. The criteria that was used allowed for consistent comparison of the knowledge and skills of students born in the same year (OECD, 2019).

For the 2018 assessment, the OECD defined reading as “understanding, using, evaluating, reflecting on and engaging with texts in order to achieve one’s goals, to develop one’s knowledge and potential, and to participate in society” (OECD, p. 15). Students were tested on their ability to identify the main ideas in a text, locate

information, and reflect on the purpose of the text. About 77% of test takers were able to perform at a minimum proficiency level or higher (OECD, 2019).

Academic Performance Among OECD Countries

According to the PISA 2018 Results, the United States scored 13th in reading, while China's provinces and municipalities, Beijing, Shanghai, Jiangsu, and Zhejiang (B-S-J-Z) together scored significantly higher in reading than any other country with a mean score of 555 followed by Singapore with 549. About 90% of these students reached the minimum proficiency level. Macao (China) had a mean score of 525, and Hong Kong (China) had 524. Western countries like Estonia were not far behind, with a mean score of 523. Canada and Finland followed with a mean score of 520 (see Appendix B). On average, about one in four PISA test takers did not attain a minimum level of proficiency in reading or mathematics, which means all countries have work to do to meet these global expectations (see Appendix B)(OECD, 2019).

For mathematics, about 76% of test takers were able to attain a minimum proficiency level or higher. The United States ranked 37th with a mean score of 478. Countries to remain on top were China's B-S-J-Z, with a mean score of 591, of which 98% attained the minimum proficiency level, and 16.5% or one in 15 students achieved the highest proficiency level of six. Singapore had a mean score of 569, of which 13.8% or one in seven students attained the minimum proficiency level of six. Macao (China) had a mean score of 558, and Hong Kong (China) had 551. For Western countries, Estonia had a mean score of 523, Canada had 512, and Finland had 507 (see Appendix C) (OECD, 2019).

For science, 78% of students from OECD countries attained a proficiency level of two or higher. Proficiency level two corresponds to skills such as the ability to recognize explanations of scientific phenomena and apply that knowledge to determine whether the findings are valid based on the data. The United States ranked 17th in science with a mean score of 502. China's B-S-J-Z had a mean score of 590, followed by Singapore, with 551, and Macao with 544. Estonia had a mean score of 530, Finland had 522, and Canada had 518. Australia, Finland, Iceland, Korea, Netherlands, New Zealand, and the Slovak Republic saw a decline in mean performance in all three subject areas since they began participating in PISA (see Appendix D)(OECD, 2019).

Vocational Performance Among OECD Countries

Stratification refers to tracking students into various educational programs. Programs are either advanced coursework or vocational programs. Students are selected for these programs based on set criteria, or they choose to participate. This review considered both types of programs. The 2018 PISA collected information from test takers on their participation in advanced coursework and vocational programs and correlated that to their achievement. It is important to note that the age at which students were tracked varied, as did the number of paths they were tracked into. The analysis of data considered these factors to see if there was a relationship (OECD, 2019).

Tracking occurs within schools by ability grouping or within courses by designating specific courses for students with similar academic abilities. Another form of tracking is between schools. Tracking between schools occurs when only designated schools offer specific programs. Students are then transported to those programs. Unique

features that can impact student achievement outcomes are the age at which students are tracked and the number of programs offered. Fifty-eight countries participated in this portion of the assessment. The number of the programs provided across these countries ranged from one to six, with three programs being the most frequent within 23 countries and four programs within 20 countries. The ages at which tracking occurred ranged from 11 years old to 16 years old. Typically, countries that tracked students at a later age offered fewer programs. Meanwhile, countries that offered more programs tracked students at a younger age. The data showed that countries with a large number of programs available to students showed a lower mean performance in reading (OECD, 2019).

In terms of vocational programs, 14% of test takers were enrolled in some type of skilled trade coursework. Students enrolled in vocational programs were more likely to attend a socio-economic disadvantaged school; thus, 22% of students in disadvantaged schools were enrolled in vocational programs compared to only 2% of students in advantaged schools. The only country where this statistic did not apply was the Dominican Republic. In fact, the percentage of students in advantaged schools was more than in disadvantaged schools. In ten countries, students in vocational programs scored higher than those who were not enrolled in vocational programs (OECD, 2019). Overall, students in countries offering fewer programs scored better in reading than students in countries offering more programs.

Comparative Research Framework

Allmendinger (1989) created a classification system to link labor market outcomes to educational systems. The American Life History Study, commonly referred to as the John Hopkins Study, the Norwegian Occupational Life History and the West German Life History Study were used to examine the percentage of students who were enrolled in primary and secondary schools and the proportion of students enrolled who exited the program by completion based on that country's criteria for completion. The study followed the cohorts into post-secondary education and then into the workforce. National education systems were ranked as having low to high standardization based on the quality of teaching across nations. They were also ranked as having low to high stratification based on differentiation within their education levels. Low and high stratification was determined by the proportion of the selected cohort to attain the maximum number of school years within each country's education system. The higher the proportion, the less stratified.

From the initial examination of data, a matrix was created using standardization and stratification as the two axes and countries occupying each cell. Using national public data sets from each country, quantitative data were used to investigate the requirements of university teacher training programs and enrollment, including vocational and technical schools, and enrollment populations entering the labor market from higher education and vocational training in order to rank these systems using the framework (Allmendinger, 1989).

The analysis showed that occupational status in a stratified system was determined by educational attainment. This relationship was less strong in an unstratified system. A standardized system was associated with seniority and longevity with one employer and preparing students for careers and the workforce. Allmendinger (1989) urges that it is not enough to say these countries are different and have different outcomes, but what is the impact of the differences on the labor market. Further research needs to explore other potential characteristics and their effects on labor market outcomes.

Allmendinger's standardization-stratification framework classified the degree of standardization as high or low. Education systems where the central government determines the curriculum for all students in the nation have high standardization. Education systems where regional or local agencies have some ability to adapt the centrally mandated curriculum, or there is no central government intervention in designing the curriculum, have low standardization. (Allmendinger, 1989; Han & Buchman; Kerchkoff, 2001; Shavit et al., 1998)

Comparative Research Findings

Table 2.0 shows the dimensions of standardization used to examine each country.

The highlighted dimensions represent high standardization.

Table 2.0

Dimensions of Standardization

U.S	Norway	West Germany
Decentralized: State and local control	Centralized: Royal Ministry of Church and Education control	Centralized: Standing Conference of State Education Ministers
There are enough schools for the population, but some may be overcrowded	Not enough schools for the population	Enough schools
Different curricula between states, communities, and schools	Different curricula between communities	Different curricula between states
State-required courses for graduation	Required courses vary by community	State-required courses for graduation
The quality of educational programs differs between communities	The quality of educational programs differs between communities	The quality of educational programs varies between states
Access to higher education differs among communities	Access to higher education differs among communities	Access to higher education is based on tracking
District curriculum	National curriculum	State curriculum
State assessments	National assessments	State assessments
Significant differences in per pupil expenditures and teacher salaries by community	Centralized control of expenditures and variation in teacher salaries by community	Insignificant difference in per pupil expenditures and more consistent teacher salaries by state

Table 2.0 - Continued*Dimensions of Standardization*

U.S	Norway	West Germany
Teacher certification system by state	Teacher credentials vary between communities	Teacher credentials valid across the nation
No formal standardized examination is required for a diploma	Formal standardized examination required for diploma	Formal standardized examination required for diploma

This comparison indicates that West Germany has high standardization, Norway has moderate standardization, and the U.S. has low standardization.

Table 2.1 shows the dimensions of stratification used to examine each country's secondary education system. The highlighted dimensions represent high stratification.

Table 2.1*Dimensions of Stratification*

U.S	Norway	Germany
No tracking into secondary programs. Vocational programs are optional.	At age 15, students are tracked into secondary programs with 2 or 4 years of additional schooling.	At age 10, students are tracked into secondary programs with 4, 6, or 9 years of additional schooling.
12 years of schooling offered	13 years of schooling offered	13 years of schooling offered
Fewer students obtain the number of years offered.	More students obtain the number of years offered for each track.	More students obtain the number of years offered for each track.

For the last dimension, accounting for differences in the number of years of education that students can obtain in each system compared to the actual number of years students

received, the data showed that students in West Germany and Norway obtained more education in terms of quantity at the secondary level than students in the U.S. When examining Norway and the U.S. at the primary education level, both countries had low stratification. From this comparison, West Germany had high stratification, and the U.S. had low stratification.

Figure 2.0 shows the application of this data to the stratification-standardization framework.

Figure 2.0

Stratification and Standardization of Secondary Education Systems

		Stratification	
		High	Low
Standardization	High	West Germany Norway (Secondary)	
	Low		USA Norway (Primary)

West Germany's education system for both primary and secondary education is in the quadrant of high stratification and standardization. Students in this system have restricted options for secondary programs because they are highly stratified. However, all students receive the same quality of education. Norway's secondary education is also in the quadrant of high stratification and standardization, but its primary education is in the quadrant of low stratification and standardization. The U.S. is also in the quadrant of low

stratification and standardization but for both primary and secondary education. Students in the U.S. have a range of options, but there is inequality in their education.

When examining West Germany, Norway, and the U.S. at the higher education level, the data showed that the U.S. had significantly more students enrolled, 663% more than West Germany, when accounting for the number of students in each system.

However, the U.S. offered a broad and well-rounded education. Meanwhile, West Germany and Norway offered a narrow education geared towards specific careers. The differences in advanced programs are due to their underlying philosophies of what an advanced degree should include. Figure 2.1 shows this data applied to the stratification - standardization framework.

Figure 2.1

Stratification and Standardization of Higher Education Systems

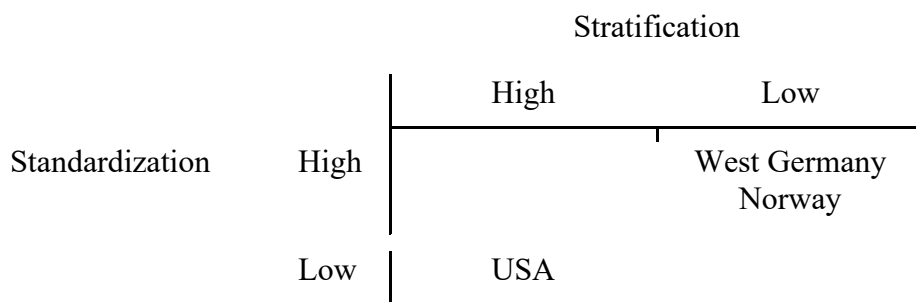
		Stratification	
		High	Low
Standardization	High		Germany Norway
	Low	USA	

The U.S. offers university admissions to all students, but due to the inequality at the secondary level coupled with the selection process, universities end up recruiting disproportionately from social levels. West Germany offers universities but only permits admissions to students who are eligible based on their secondary program, which means some students do not have access to universities at all.

When examining West Germany, Norway, and the U.S. vocational training programs, four different types of vocational training were identified: training in general education schools, training in vocational schools, apprenticeships in firms, and on-the-job training. At the time the study was conducted, the U.S. only provided vocational training in general education schools. Hence, the study included on-the-job training and vocational training to account for differences among vocational training programs in West Germany and Norway. West Germany and Norway predominantly offered apprenticeships as vocational training. Figure 2.2 shows this data applied to the stratification-standardization framework.

Figure 2.2

Stratification and Standardization of Vocational Training Structures



The framework shows the U.S. having high stratification and low standardization, while West Germany and Norway have low stratification and high standardization. Students in the U.S. have a “higher opportunity to obtain the maximum number of school years provided by the system” (p. 239). However, opportunities are restricted by stratified higher education systems that are rooted in barriers to social status. Students in West Germany and Norway have opportunities that are equally distributed among those who have reached higher education and vocational training.

Allmendinger (1989) applied the standardized-stratified framework to labor market outcomes. This empirical study showed that the “effects of educational attainment on occupational rewards are dependent on the educational system in which education has been pursued” (p. 247). As concluded previously, the proportion of students completing the maximum level of education provided was higher in a highly standardized and stratified system, which means “the amount of schooling a person attains and the occupational career a person experiences are dependent on the educational environment” (p. 232).

Figure 2.3 demonstrates that in stratified systems, there is a tight coupling between the education system and the occupational structure, resulting in the least number of job shifts, as represented by -. The number of job shifts is correlated to the degree to which the education systems are stratified. In unstratified systems, there is a loose coupling, which results in more job shifts, as represented by the ++.

Figure 2.3

Effects of Standardized-Stratified Educational Systems on The Propensity of Lateral and Vertical Career Mobility

		Stratification		
		High	Low	
Standardization	High	-	+	Tight coupling
	Low	+	++	Loose coupling

“Education systems define occupational opportunities for individuals at entry into the labor market, and these systems have long-term implications for how people are

matched to jobs” (Allmendinger, 1989. Page 232, Buchmann & Hannum, 2001). As students matriculate through the education system, they obtain various types of credentials. The U.S. refers to the high school diploma as a significant level of educational attainment. Credentials like Advanced Placement, International Baccalaureate, Honors, and Career and Technical Education are not nationally recognized as a level of educational attainment in the United States. These programs are not offered consistently across districts and often have limited availability for student enrollment. When considering the total population of a district, these programs only allow access to a very small population of students. Thus, the one educational attainment in the U.S. is the diploma, so all students end their secondary experience with the same credentials.

In West Germany and Norway, students have several nationally recognized levels of educational attainment, which act as screening tools for employers. West Germany’s Mittelschulen and Norway’s Realskolen led to examinations that allow entry into white-collar jobs. Norway’s Volksschulen certificate qualifies students for entry into an apprenticeship. Thus, there is a tight coupling between educational attainments and labor market outcomes.

Today, Germany has one of the most comprehensive stratified systems offering three types of secondary program certificates. The Gymnasium offers the Abitur, entitling entry into a university; the Realschule offers the Fachoberschule, entitling entry into advanced vocational training; and the Hauptschule, which provides few options for

higher education. These credentials allow students access to social mobility through occupational attainment. Spring (1976) offers the idea of the education system as a society's institutionalized 'sorting machine' because it tracks the population into the labor market and, in turn, into social classes.

Stratification in Education

Stratification in Mathematics

Secondary mathematics attainment is a strong predictor of college entry and mathematics course-taking related to college completion. Thus, when students get tracked into remedial courses, they are never able to attain the level of math needed for college entry. Researchers are now investigating the tracking of students in mathematics upon entry into high school and how that placement affects the progression through their course sequence (Ayalon & Livneh, 2012; Tyson & Roksa, 2016).

There has been a shift in education where students are encouraged to work at their own pace, but their pace may not put them on track for future success. Many schools offer various Algebra I course levels—Tyson and Roksa (2016) categorized course offerings as remedial, general, and honors. A review of the course curriculum discovered that general algebra and honors algebra cover the same five units of content. The curriculum for remedial algebra took the same five units of content and spread them over two years.

Tyson and Roksa (2016) investigated the practice of tracking eighth-grade students in high school algebra courses. They theorized course placement should closely match the level of course preparation. Low-preparation students would take remedial

algebra, average-preparation students would take general algebra, and high-preparation students would take honors algebra. Student preparation was measured by a standardized math test given to all eighth-grade students prior to entering the ninth grade. The sole purpose of the math test is to determine math proficiency in order to place students in remedial algebra, general algebra I, or algebra I honors.

Tyson and Roksa (2016) found that many students were placed into less rigorous or more rigorous courses than their level of preparation. The variation in program placement was attributed to a lack of course offerings at some high schools. Therefore, some students were placed in courses simply because the appropriate course was not available. In order to determine the consequences of student placement, they examined 12th-grade math attainment while controlling for eighth-grade preparation.

Tyson and Roksa (2016) examined 1631 student transcripts across the state of Florida to identify the sequences of math courses taken in order to determine the variation of math placement and curriculum units taught in each algebra course. A multilevel analysis determined whether the highest level of math attained in high school was associated with initial placement in ninth grade and the curriculum taught for that course. As would be expected, math attainment, placement, and achievement were highest among students with the highest standardized test scores, as were the lowest among students with the lowest test scores.

The study found that students in schools offering remedial courses were less likely to reach Algebra II and precalculus, including students in general and honors courses, compared to their peers in schools that did not offer remedial courses. Schools

that did not offer remedial courses eliminated the negative effects of taking remedial algebra and offered the positive effects of taking algebra honors. Students in schools that did not offer remedial algebra were better able to overcome their low preparation and math attainment.

The horizontal stratification revealed how the curriculum and streaming of students into the highly structured math sequence is important for later math attainment. For students with low preparation, more math instruction would be of greater benefit, so enrolling them in general algebra and an additional algebra support course may yield higher math attainment (Ayalon & Gamoran, 2000). Tyson and Roksa (2016) concluded that Algebra I honors courses implied higher expectations for students to complete pre-calculus. Students may have then risen to those expectations. Once students are met with math success, they may also begin to develop aspirations for Science, Technology, Engineering and Mathematics (STEM) fields. In terms of the courses offered, remedial algebra had no positive effects. Students in remedial algebra were at a clear disadvantage regardless of their preparation. Even students with moderate to high achievement placed in remedial algebra did not yield any positive effects. Nor did the students in general and honors algebra fare better by not having the lower preparation students in their courses (Tyson & Roksa, 2016; Walberg & Tsai, 1983).

National research studies have extensively studied the gender gap in mathematics. International data sources like the PISA and Trends in International Mathematics and Science Study (TIMSS) have made it possible to use comparative data between countries to examine the gender gap in achievement. Ayalon and Livneh (2012) and Tyson and

Roksa (2016) agree that course-taking is a predictor of future math achievement, and the lack of remedial programs increases overall math achievement. The high expectations within mathematics courses and exposing students to rigorous content may be motivating factors for reaching high standards regardless of gender, preparation, and socioeconomic status (Walberg & Tsai, 1983).

Ayalon and Livneh (2012, p. 435) hypothesized that “standardized and stratified education systems would be linked to the moderation or even elimination of the gender gap in mathematics achievement regardless of the degree of gender stratification and economic development.” The 2003 TIMSS used a sample of 137,666 eighth-grade students in 32 countries and the United Nations Development Data (UNDP) variables to measure economic development and gender stratification. National research coordinators worked with curriculum experts in each country to determine the variation of time devoted to major mathematical topics: addition, fractions, problems, data tables, and equations. Teachers were asked how often they referred to these mathematical topics. The survey used a scale of never, some lessons, half of the lessons, almost all, and all lessons.

In order to determine the effects a standardized education system has on socioeconomics, a Human Development Index (HDI) was used, which included a combination of life expectancy, educational attainment, and standard of living indicators. Three domains represented gender stratification: the labor market, politics, and family. The labor market was measured by the percentage of women in the labor market. Political empowerment was measured by the percentage of women in parliament and government. And family life was measured by adult and adolescent fertility rates.

Results from this study revealed that higher uniformity in time devoted to various math topics is associated with a reduction in scores related to the gender gap, the odds of excelling, and the odds of failing. Low between-teacher instructional variation is associated with a significant increase in gender equality. The use of national examinations is also related to the narrowing of the gender gap in math scores and in the odds of failing (Bishop, 1993). The combination of national examinations and low between-teacher instructional variation is linked to a significant increase in gender equality in math scores and an increase in gender inequality in favor of girls in the odds of failure (Ayalon & Gamoran, 2000; Broaden, 1997).

Lower gender inequality was associated with countries that centralize the curriculum through national examinations and that exposed students to similar math topics. The level of standardization was more central than women's economic and political activity, the aspect of family, and the country's human and economic development in shaping gender inequality in math. The educational experience that students get in school is more significant than signs and expressions of gender prevalent in society and school.

Stratification in Science

Career aspirations of secondary students are strong predictors of educational and occupational attainment (Akos et al., 2007). However, many students find themselves ill-prepared for their ambitions of working in STEM related fields once they enter higher education. About half of all college students in STEM-related fields leave their programs

before earning a degree. Moreover, half of those students switch to non-STEM-related fields (Han & Buchmann, 2016).

Akos et al. (2001) discussed in Gottfredson's (2002) theory of career aspirations as "a process of circumscription and compromise in which an individual may change his or her original career choices to ones perceived as more appropriate or accessible."

There are many factors that influence the career aspirations of students. Systemic familial factors include socioeconomic status, career aspirations determined for the student, level of education, race, and ethnicity. Intrapersonal factors, such as self-determination, self-reliance, self-control, self-concept, and interpersonal skills also play a role. Finally, one cannot discount the factors that inequality in our education system has on student aspirations, including pre-determined assumptions of staff and administrators.

Research shows that there is a disparity between Black, Latino, and Hispanic students who desire to go to college and those enrolled in coursework that leads to college preparation (Mahoney & Merritt, 1993). According to the OECD report (2012), about 60% of students plan to work in science-related careers. High-achieving students are more likely than lower-achieving students to have a strong desire to work in a science-related field. One might assume high-achieving students would be more prepared for a science-related field. Yet, our education system has not been successful in attracting these students to higher education science majors.

Han (2015) studied the degree to which national standardization of education systems is associated with students' STEM occupational expectations, specifically the subfields of computing and engineering and health services. He examined the association

between the degree of stratification of educational systems and students' STEM expectations. He also assessed the degree to which the association between education systems and students' STEM expectations differed by ability.

The single open-ended question on the 2006 PISA occupational survey asked 15-year-old students from 55 countries what type of jobs they would expect to have at the age of 30. The responses were classified using the International Standard Classification of Occupations 88 (ISCO-88). STEM-related fields included mathematics, natural science, engineering, computing, and health services. This study examined the subfields of engineering, computing, and health services.

Curriculum standardization was measured using a classification of curricular policies developed by Montt (2011). Countries were classified into three groups based on their education policies: countries with no central government control over the curriculum, countries with regional or local agencies that have some ability to adapt a centrally prescribed curriculum, and countries where the central government determines the curriculum. The number of school types available to 15-year-old students in each country measured the stratification of educational systems. The gross domestic product per capita and the level of educational investment were measured by public education expenditures per student in secondary education as a percentage of per capita.

Han (2015) found that higher levels of stratification were associated with lower student expectations of health services for both boys and girls. Student expectations for computing and engineering were not associated with any characteristics of educational

systems. Higher levels of curricular standardization were associated with lower expectations for health services among girls. Health services expectations remained constant for boys. Akos et al., 2007, asserted that systemic barriers like dissemination of program information (Kim et al., 2021), hidden prerequisites coupled with the sense of safety and identity found in lower-level classes with their peer groups may skew these results.

The association between national education system features and certain types of STEM expectations differed across student performance. The negative effect between standardized systems and health services expectations was stronger for low-performing students in science than for top-performing students in science (Akos et al., 2007). The negative association between stratified systems and health service expectations remained consistent across student performance levels.

Gender characteristics showed that girls were five percent more likely than boys to have a STEM career (Akos et al., 2007). Girls were also more likely to have a health services career but less likely to have a computing and engineering career. First- and second-generation immigrants were more likely to have a STEM expectation than native students. First-generation immigrants were 48% more likely to have a STEM career, and second-generation immigrants were 36 % more likely to have a STEM career. This pattern remained constant among STEM subfields and gender.

Han and Buchmann (2016) and Han (2015) agree that there is a flight from science phenomenon across many countries, including those that are top performers in math and science. Many researchers have been trying to determine the root cause of this

phenomenon. Some say it is the standardization of education systems, while others say it is the lack of secondary preparation for the rigor of higher education. These concerns have caused researchers and governments to find ways to attract students toward STEM education programs and occupations (Han & Buchmann, 2016) (Han, 2015).

Han and Buchmann (2016) hypothesized that countries with curricular standardization exhibit higher mean science achievement and smaller gender and class gaps. The higher the standardization, the greater the alignment of students' science achievement and their future orientation toward STEM fields. They further predicted that in standardized systems, high-science performers might be more likely to pursue STEM fields due to the transparency of being measured against a standard.

Previous studies considered the outcomes of all countries, whereas this study compared the U.S. with other industrialized countries. The comparison aimed to determine if the low standardization of the U.S. education system was related to high attrition rates of college students from STEM fields. If so, this would explain the achievement gap between the U.S. and top-performing countries and shed light on the phenomenon of flying from science in the U.S.

The study used the 2006 PISA data for 27 industrialized countries for comparison (World Bank, 2005). The researchers selected a subset of students from each country based on the student's interests in pursuing a degree or career in a STEM field according to the PISA future orientation index. The index included the following four questions: I would like to work in a career involving science, I would like to study science after

secondary school, I would like to work on science projects as an adult, and I would like to spend my life doing advanced science.

Curricular standardization was determined using Montt's (2011) model. Out of the 27 countries, the study identified seven as highly standardized, 16 were moderately standardized, and four had no standardization. An index of economic, social, and cultural status (ESCS) derived from the PISA measured family socioeconomic status. The index uses the student's home possessions, the highest level of occupation of either parent and the highest level of education of either parent expressed during the school year. The gross domestic product per capita measured the economic development and inequality of each country. Student ratings of the ease with which they believed they could perform eight science tasks measured science efficacy. Science activities were measured by how frequently they watched television, borrowed or purchased books, visited websites, listened to the radio, read magazines and newspapers, or attended a club related to science. The hours spent in science classes measured instructional hours in science.

The results revealed that students in the U.S. who aspire to a STEM major or career scored lower than students in most developed countries in terms of science achievement. Even students highly oriented towards STEM were behind most developed countries in science performance. When analyzing the proficiency levels, the majority of U.S. students scored in the bottom third, which was clear evidence of a lack of proficiency in college STEM courses (Han & Buchmann, 2016). In standardized systems, female students had lower achievement levels than males, but the gap was very small. Immigrant students scored lower than native students. Students from higher

socioeconomic families and those who reported higher science self-efficacy had significantly higher science scores. Students who spent more hours learning science and engaged in more science activities had higher science scores. A moderately standardized curriculum was associated with a 40-point gain in science achievement, and a highly standardized curriculum was associated with a 27-point increase. Thus, curriculum standardization is associated with improved individual science performance.

Standardization in Education

Adherence to High Academic Standards

An underlying aspect of the standardization-stratification framework is the adherence to high academic standards. Differentiation of instruction is a common educational practice among teachers at all levels. The concept of differentiation is a response to address the varying academic abilities of students within a classroom. Differentiation is tailoring instruction to students' strengths so they can obtain the skills and knowledge necessary to meet the curricular standards. It is also limited to the curricular offering of each school and the teaching staff available. Comparative research suggests the gap of inequality in achievement can be either minimized or maximized by the fidelity of implementation of differentiation.

For example, Broaden (1997) researched tracking and educational aspirations of Taiwanese junior high students. He found placement in high ability tracking and grade point average to be strong predictors of academic aspirations and high school placement. He also found that ability grouping contributed to greater educational opportunity in

Taiwan due to consistency in national standardization of curriculum coupled with smaller racial, ethnic, and income inequalities in Taiwan.

Ayalon and Gamoran (2000) investigated the practice of differentiation at the secondary level in Israel and the United States. The goal of secondary education in Israel was to prepare students for their exit assessment, known as the matriculation examination. Meanwhile, the United States prepared students to enter the workforce or attend college. The differentiation practices towards each country's respective goals.

In the Israeli education system, the curriculum was aligned with the matriculation examination, thus requiring a satisfactory score to earn a bagrut (diploma). Students' success in the matriculation examination carried a great deal of prestige among schools and teachers. Since prerequisites for college admission are contingent upon students' performance on the examination, students were motivated to do well. The labor market also tied the examination to employment opportunities for students who had a bagrut. Therefore, students of all socioeconomic statuses had a vested interest in the matriculation examination and the bagrut.

The education reform in Israel gave students more choices among subjects to study. Each subject was offered at different academic levels, although all levels aligned to the examination. The leveling system created various bagruts. Some bagruts were simply awards of completion, while others were associated with monetary bonuses from universities. The leveling system of the subjects created competition among students who wished to take more advanced courses.

In the United States, differentiation tracks for Algebra I were Pre-Algebra, Algebra I, and Honors Algebra. Once students entered the Pre-Algebra track, they could not break the course sequence by taking an advanced or honors course. In this case, adherence to the Pre-Algebra math track was found to perpetuate a cycle of students always lagging behind their peers. Placement in Algebra I and Honors Algebra required successful completion of Pre-Algebra in junior high and sometimes teacher recommendations were also needed. “Differentiation, ability grouping in academic courses, magnifies inequality of achievement” (Ayalon and Gamoran, 2000, p.58).

Ayalon and Gamoran theorized that Israeli students in differentiated programs achieved higher academic averages and experienced reduced social inequality due to meaningful curricular levels and matriculation examinations. They further theorized that United States students in differentiated programs led to lower academic averages due to low-level courses within a subject, thus increasing social inequality. Their findings revealed that in Israel, a differentiated curriculum was associated with higher average achievement in English and lower social disparities in achievement in English and Mathematics. In the United States, they found that differentiation was associated with lower average achievement and high gaps between minorities and socioeconomic status (Akos et al., 2021).

Curriculum-Based Exit Examinations

Another underlying aspect of the standardization-stratification framework is curriculum-based exit examinations. Bishop (1997) used the TIMSS assessment data to

conduct comparative research on countries with secondary exit examinations in math and science and those without exit examinations. He identified 21 countries that had a curriculum-based external exit examination (CBEEE). Those countries included Bulgaria, Columbia, the Czech Republic, Denmark, Hong Kong, Hungary, Ireland, Iran, Israel, Japan, Korea, Lithuania, the Netherlands, New Zealand, Russia, Scotland, Singapore, Slovak Republic, Slovenia, Thailand and the United Kingdom. Countries without a CBEEE included Belgium, Cyprus, Greece, Latvia, the Philippines, Portugal, Spain, and Sweden. College entrance exams were used as a CBEEE for Greece, Portugal, Spain, Cyprus, and the United States. The results indicated that test scores were significantly higher in more developed nations in East Asian countries and in those with a CBEEE.

The impact of a CBEEE was about one U.S. grade level equivalent in math and 1.2 grade level equivalent in science. Bishop conducted similar research using the International Assessment of Educational Progress (IAEP) for England, France, Hungary, Ireland, Israel, Emilia Romagna/Northern Italy, Korea, Portugal, Scotland, Slovenia, Soviet Union, Spain, Switzerland, Taiwan, and the United States. The results indicated the math test scores were significantly higher, two U.S. grade levels higher, for countries with a CBEEE. Overall, East Asian students scored significantly higher than students in Europe and North America.

Equity in Career and Technical Education

Kim et al. (2021) conducted a literature review of 123 sources, noting trends in Career and Technical Education research between 1997 and 2019 in the United States. To

examine how CTE programs affect educational equity, Kim et al. (2021) adapted a novel equity framework from Benadusi (2001) and Meuret (2001). The equity framework encompassed three standards of equity for investigation: educational adequacy, equal treatment, and equal educational opportunity (Fiske & Ladd, 2004). Each area defined indicators for assessing equity in CTE programs.

Table 2.2 shows educational adequacy, defined as the “sound basic education” each student receives in preparation to meet the minimum proficiency determined by the academic standards. Thus, leading students to active engagement in citizenship and to “compete effectively in the modern economy” (Rebell, 2009, p. 21; Kim et al., 2021).

Table 2.2

Educational Adequacy in CTE

Learning Standards	These are aligned with Common Career Technical Core, Common Core State Standards, and Next Generation Science Standards. All program completers across schools and demographic subgroups possess the minimum competencies outlined in the standards.
Resource inputs	CTE teachers meet the certification and professional development requirements of the states in which they work. CTE teachers use culturally responsive and sustaining pedagogies. CTE programs have safe facilities with materials and equipment appropriate to the nature of the career training they provide. CTE funding is sufficient for cultivating basic employment and citizenship skills.

The learning standards component refers to indicators addressing academic standards aligned to coursework and credentials with the expectation that all students will obtain

the minimum competencies. The resource inputs component refers to indicators addressing teacher certification and credentials, including culturally responsive teaching practices and adequate funding to provide facilities, equipment, and materials for a safe learning environment (Kim et al., 2021).

A minimum standard of quality incorporates rigorous academic and technical standards in an authentic way that provides students with experiences with real-world application. In a study conducted by the National Research Center for Career and Technical Education (2007), “teachers reported that standards improved rigor, credibility, and parity with academic courses while attracting higher performing students, but they also reported that standards were not consistently implemented” (Kim et al., 2021). Researchers believed the inconsistency of implementation among teachers was due to a lack of state mandates requiring standards, which led teachers to think they were optional. A follow-up study from the National Association of State Directors of Career and Technical Education Consortium (2013) “found that few states adopted the National Career Clusters Framework in a way that positively affected the use of standards in the classroom” (Kim et al., 2021).

Researchers found that about 80% of CTE teachers nationwide are considered highly qualified by their respective states. CTE teacher licensure requirements differ greatly from academic teacher certification. Many states have seen an increase in CTE teachers entering education from industry via alternative pathways to teacher certification. Due to the alternative pathways, CTE teachers bypass required coursework that prepares teachers to work with diverse student populations like students with

disabilities, English language learners, and economically disadvantaged students.

“Cultural proficiency training for teachers is essential because it not only helps them understand and respect the cultural backgrounds of their students but also fosters an inclusive and supportive classroom environment that leads to better academic outcomes for all students” (Kim et al., 2021).

The field of education demands that teachers continue to hone their craft throughout their educational careers. Engaging in self-reflection of one’s practice leads to self-evaluation and refining one’s skills. Teachers engage in this process to understand the impact their teaching has on student learning. Sturko and Gregson (2009) found that CTE teachers needed continued professional development in integrating academic standards and developing students' critical thinking and problem-solving skills. There is a presumption that CTE teachers primarily need to be knowledgeable of industry-specific credentials. However, the priority should be skills that directly relate to working effectively with students.

Table 2.3 shows that equal treatment is defined as having “equal worth,” “equal effects,” or equity across schools. Providing the same treatment may not produce the same effects for some students. For example, a special education student may need specific support that other students do not need. Under equal treatment, the program should provide such support in order for the program to have an equal effect on that student or group of students (Meuret, 2001, p. 93; Stone, 2011; Kim et al., 2021).

Table 2.3

Equal Treatment in CTE

Program distribution (across schools)

Quality The distribution of program types is independent of student body composition.

The distribution of program types across schools reflects variations in the needs and interests of local communities.

Program efficacy and rigor are independent of school location and student body composition.

Quantity A number of CTE programs are accessible independently of school location and student body composition.

The length or intensity of CTE programs accessible is independent of school location and student body composition

Program access (within schools)

Student's background characteristics do not influence staff decisions regarding CTE placement.

CTE program admission policies and procedures (e.g., entrance exams, scheduling, transportation, etc.) do not discriminate against student subgroups.

Patterns of CTE program participation result from variations in students' interests and capabilities.

The demographic composition of CTE courses is not significantly different than the demographic composition of non-CTE courses.

Demographic composition also does not vary significantly across CTE programs within a school.

The program distribution component refers to quality and quantity indicators addressing the types of programs and the level of rigor across all schools regardless of their geographic location or student demographics. The program access component refers to program admissions, placement, and patterns of participation irrespective of geographic location or student demographics. Student demographics should resemble those across the school or other programs available at the school. Access to program awareness and communications publicizing programs directly influences overall program demographics (Kim et al., 2021). If students and their families are unaware of programs offered or do not understand the benefits of a program, then one may argue they do not have access to that program

In a review of the literature, Kim et al. (2021) found no research on program distribution by type and very little on the distribution of program quality. One study by Stull et al. (2000) found that school and district size did not lead to an increase in CTE offerings. However, he did find a relationship between leadership skills and CTE offerings, suggesting that leaders with strong skills in innovation, school climate, and cooperation offered more CTE types. A few studies suggested that schools in rural areas primarily offered blue-collar CTE program types. This finding supported the lack of white-collar industries and community colleges situated in rural communities, which contributed to an inability to offer more diverse CTE program types. This study also found that there were fewer females in CTE programs, and females were less likely to secure a blue-collar job after graduation.

Using the 1997 National Longitudinal Survey of Youth, Fletcher and Zirkle (2009) found that Black students were twice as likely to participate in CTE than White students. Research to support this finding noted that White students, students from high-income families, and girls were significantly more likely to participate in more advanced academic courses (Evan et al., 2013; Fletcher; Cox, 2012). CTE completers, those students who completed all of the courses in a single career pathway, were more likely to be male and economically disadvantaged compared to non-CTE students. There was also a disproportionate number of low-income students, students with disabilities, and English language learners who completed a CTE pathway (Reed et al., 2018). As the industry increased its demand for higher-skilled workers in fields associated with career and technical education, the income of these skilled workers also increased, thus making these jobs more desirable for upper-income white students. In recent years, CTE has seen a shift in the selection process students must go through in order to enter CTE programs.

Table 2.4 shows equal educational opportunity, defined as students having “the same chance of using their acquired skills to realize” their future goals (Demuese et al., 2001, p. 70).

Table 2.4

Equal Educational Opportunity in CTE

Achievement	Achievement outcomes (e.g., test scores and grades) are independent of CTE participants' background characteristics. CTE participants' achievement positions them for employment in a field that supports full-time labor at a thriving wage.
Attainment	Attainment outcomes), e.g., credentials and degrees earned are independent of CTE participants' background characteristics. CTE participants' attainment positions them for employment in a field that supports full-time labor at a thriving wage.
Social-emotional skills	The magnitude of growth in social-emotional skills is independent of CTE participants' background characteristics. The nature of growth in CTE participants' social-emotional skills is transformative, responsive to their cultural backgrounds, and sustaining their cultural assets. In ways that are culturally responsive and sustaining, CTE participants develop social-emotional skills that support their scholastic success. In ways that are culturally responsive and sustaining, CTE participants develop social-emotional skills that position them to thrive in the labor market.
Labor market outcomes	CTE participants' economic mobility (e.g., transition to the labor market, wages) is independent of background characteristics. CTE participants' status mobility (e.g., job prestige, social class) is independent of background characteristics.

Equal educational opportunity has four components: achievement, attainment, social-emotional skills, and labor market outcomes. Achievement refers to the outcomes of school performance reflected in report card grades and test scores. “Attainment refers to post-secondary outcomes like dropout rates, college attendance, and completion” (Alexander, 2001, p. 175). Social-emotional skills refer to dispositions like self-efficacy and soft skills valued by employers (Meuret, 2001). Educational outcomes are closely tied to labor market outcomes and future earnings. Employment status and income lead to social mobility. Therefore, educational outcomes have lifelong effects on one's future earnings (Kim et al., 2021).

Kim et al. 2021, found that the research on CTE and achievement had contradictory outcomes. For every study that found a positive relationship between CTE and achievement, there was a study to dispute the prior finding. The contradicting research demonstrates that research on a larger scale is needed and that student demographics may account for the conflicted findings. Two studies found a positive relationship between CTE programs and the attainment of credits earned and advanced placement courses taken. The nuance of these two studies was that the student demographics were White and Asian males from high-income families.

Dougherty et al., 2018 found that participation in high-quality CTE programs was associated with on-time graduation by 3 - 5% for higher-income students, 7% for low-income students, and students with disabilities were 70% more likely to graduate in four years compared to their non-CTE disabled peers. CTE concentrators, students taking a minimum of three CTE courses, were found to graduate at higher rates on average than

non-CTE concentrators. Castellano et al., 2007, found that the odds of dropping out of high school decreased as the proportion of the students' time devoted to CTE courses increased.

COVID-19 exacerbated educational disparities for marginalized student populations, heightening the necessity for schools to address and support student's social and emotional needs. In order to mitigate the negative effects of COVID-19, schools must implement social-emotional learning strategies to foster a more equitable educational environment. Research suggests that soft skills contribute to an increase in self-worth and self-efficacy and, in turn, increase student achievement. CTE programs may contribute to these outcomes, but research that disaggregated data by subgroups, much like achievement and attainment, was not found (Kelly & Price, 2009; Austin, 2010).

Education and Labor Market Outcomes

Green et al. (2015) analyzed the inequality of adult skills outcomes and opportunities using the OECD Survey of Adult Skills (2013) and The Survey of Adult Skills (SAS). The study was conducted from 2011 to 2012 in 25 countries, with adults aged 16 to 64 years. The International Adult Literacy Survey (IALS) was administered in 23 countries between 1994 and 1998. Green et al. compared the two data sets to assess trends in literacy and numeracy skill inequality between the two surveys. Additionally, the 2000 PISA was used to determine changes in inequality between the ages of 15 and 27.

The study revealed that the U.S. had the highest level of inequality in numeracy, followed by Canada and France. For literacy, the U.S. scored in the top half of the national inequality ranking even though there was no significant difference. When looking at the average values for literacy and numeracy, the U.S. was distinctly more unequal on average. In terms of inequality in numeracy and literacy skills, the U.S. was the top country in terms of numeracy skills inequality, which was evident among the 25- to 29-year-old age group. The data suggests that initial education before age 25 may provide the source of the differences in the inequality of adult skills. Cross-country evidence also indicated that inequality in income had a weak effect on inequality skills. Overall, the study suggested that there may be system characteristics driving inequality at different phases of education.

Conclusion

Comparative studies in education have become more feasible with international assessments like the PISA and TIMSS. Technology has propelled the global economy in real time, making education a growing concern for economic stability. The effects of globalization on schooling are causing researchers to take a closer look at how education systems as a whole can impact student achievement, outcomes, and opportunities. The standardization-stratification framework presented is just the beginning of deeper dives into more specific characteristics of education systems that impact student learning. The greatest impact that needs further research is the extent of the impact these theories have on equalizing gender, ethnicity, and socioeconomic status across a nation.

CHAPTER THREE

METHODOLOGY

The purpose of this study was to investigate the relationship between the degree of standardization-stratification and student achievement. From this point, the study investigated the relationship between the degree of standardization-stratification and equitable access to CTE programs. Due to the increased focus on equity and inclusion since the COVID-19 pandemic, many school districts have reviewed their processes to be more inclusive and equitable. The standardization-stratification model illuminated areas for districts to investigate to ensure equity and access for all students. This study assumed all systems have room for improvement with respect to the implementation of academic standards, tracking students into programs, and inclusion based on historical systems data. The research questions to be addressed within the context of this study were:

1. What impact did the degree of standardization-stratification have on student achievement?
2. What impact did the degree of standardization-stratification have on achievement gaps among subgroups?
3. What impact did the degree of standardization-stratification have on equitable access to CTE programs?
4. How have districts standardized-stratified their CTE programs?

Research Design

As the researcher for this study, I applied a pragmatic approach using a mixed methods design. Pragmatism in education emphasizes that the truth of an idea comes through the verification of real-world experiences, meaning a thought or suggestion is accurate if it works effectively in real-life situations and experiences. Researchers collect data about how people behave and interact in their everyday lives to gain insights into natural occurrences and behaviors, often through methods like observational studies, surveys, or field experiments, capturing a more authentic view of real-life situations. Research exists to find the truth, and the truth is made from reflection and understanding of real-life events. Reality is in becoming or the process of becoming to gain knowledge and improve the human condition. We must work within the existing constraints to see improved outcomes.

In this study, standardization and stratification are an existing constraints of our educational system. As the researcher, I want to know how these constraints impact student achievement, inclusion, and equitable access. Education plays a central role in solving human problems. A free public education is a fundamental right we have as Americans. The degree of access to our education system determines the future wealth of students. (Badley, 2013; Johnson, 2016; Rawls, 1999; Sukamolson, 2007).

The logic of Pragmatism is the inductive reasoning and experimental approach to new knowledge and solutions to problems. Our education system changes as evidence-based research practices are adopted and integrated into the system. With research comes

new knowledge and changes that yield higher achievement for students. The knowledge of consequences or outcomes guides our decisions based on our moral beliefs, which determines our truth. Research can predict outcomes and determine if relationships exist between variables, which is why educators have an ethical obligation to apply research findings to improve outcomes. The Pragmatist Approach to research allows me to use both quantitative and qualitative research methods in this study (Badley, 2013; Johnson, 2016; Rawls, 1999; Sukamolson, 2007).

Quantitative research is often contrasted with qualitative research because their philosophies on how to approach and conduct research are quite different. Quantitative research uses numerical data that is analyzed using statistics, whereas qualitative research uses non-numerical data analyzed in units of language from which themes emerge. Because we associate these two forms of research as being opposites of one another, we may think they are incompatible or conflict with one another. Some researchers gravitate to either quantitative or qualitative research based on their philosophical view of the world (Belotto, 2018; Sukamolson, 2007).

Quantitative research emphasizes a realistic view of the world, while qualitative research emphasizes a subjective view of the world. Realists believe it is their job to expose reality as it exists. The researcher employs strict objective methods, detaching themselves from the research. Scientific methods drive quantitative research. Qualitative research applies empirical statements by describing what “is” the reality rather than what “ought” to be the reality. Empirical evaluations quantify reality with numbers to

determine the degree to which the practice is meeting or not meeting the identified standard (Cohen & Manion, 1980; Badley, 2013).

In educational research, data that does not exist in quantitative form or that cannot be easily measured numerically can be collected qualitatively by the researcher. Qualitative research collects rich descriptive information that quantitative methods would not have otherwise captured. Research design instruments like surveys measure perceptions, a phenomenon that does not naturally occur in a quantitative form. When perceptions are collected using a Likert Scale, they are correlated to quantitative data using a numeric scale with responses ranging from agree to disagree. The Likert Scale provides a means to collect perception data that can be analyzed using statistics (Sukamolson, 2007).

Creswell (2019, p.627) defines quantitative research as,

“An inquiry approach useful for describing trends and explaining the relationship among variables found in the literature. To conduct this inquiry, the investigator specifies narrow questions, locates or develops instruments to gather data to answer the questions, and analyzes numbers from the instruments using statistics. From the results of these analyses, the researcher interprets the data using prior predictions and research studies. The final report, presented in a standard format, displays researcher objectivity and lack of bias.”

Quantitative data can be collected using surveys or interviews to capture the way people think about issues or the practices they use. Surveys are information-collection methods

and can be self-administered by participants of the study. Participants can complete the survey at a time that is convenient and in a setting where they are most comfortable. An advantage of using surveys is that they can be administered in a short amount of time using an online application. For this study, Qualtrics will be used, which allows for rapid results (Creswell, 2019; Fink, 2009).

There are two types of research survey designs: longitudinal and cross-sectional. Cross-sectional survey designs are employed when comparing two or more groups, measuring needs, or as an assessment. Cross-sectional surveys collect data at one point in time, measuring current perceptions and practices. Perceptions refer to the knowledge, attitudes, beliefs, and competencies the participants have about an issue. Practices are the actions or processes of the participants in relation to a problem. Cross-sectional survey design is widely used in education for collecting quantitative and qualitative data (Creswell, 2019; Fink, 2009).

In qualitative research design, subjectivists believe that the role of the researcher is subjective and constructed by the observations. This perspective acknowledges that the researcher's subjective viewpoint influences the research process. The researcher, as a human being with emotions and beliefs, shapes their observations and interpretations, transforming them into a reality. There is value in one's lived experiences, and people with similar experiences may hold similar or contrasting views. The researcher's interpretation of the observations, as a research participant, builds the reality documented in the research. All of these are things from which the researcher can learn. Therefore, the truth is only relative and never definite (Belotto, 2018; Sukamolson, 2007).

Creswell (2019, p. 627) defines qualitative research as,

Qualitative research is an inquiry approach useful for the exploration and understanding of a central phenomenon. To learn about this phenomenon, the inquirer asks participants broad, general questions, collects the detailed views of participants in the form of words or images, and analyzes the information for description and themes. From this data, the researcher interprets the meaning of the information, drawing on personal reflections and past research. The final structure of the final report is flexible, and it displays the researcher's biases and thoughts."

Researchers use qualitative research when they want to gather information about a phenomenon but do not necessarily know the variables. Data collection instruments such as interviews, focus groups, observations, a review of documents, or audio-visual materials allow for the exploration of the phenomenon by learning from the participant's lives. Through data analysis of the words and phrases, themes emerge around the phenomenon that the researcher may not have predicted. Explores these themes or design variables may lead the study in an unexpected direction. (Belotto, 2018; Creswell, 2019).

Theorists of quantitative and qualitative research appreciate the views of both designs. Quantitative theorists acknowledge the true reality that human beings have emotions and beliefs that are influenced by the social and political climate in which the research is conducted. At the same time, qualitative research methods span a continuum to the degree that some of the methods are quite close to the realistic view. To apply such strict labels to those who conduct quantitative and qualitative research would not be

appropriate. Numerous mixed-method studies show that researchers find value in both forms of research. Many researchers believe that a mixed-method study adds validity because the researcher is gathering multiple forms of data and seeing the phenomenon through two different lenses. The goal of the researcher must be to conduct a study that attempts to represent reality as accurately as possible. A researcher must have confidence that the findings from the data can be relied on to predict outcomes (Sukamolson, 2007).

This study uses a mixed methods approach to address the research questions. The mixed method research design is a procedure for collecting, analyzing, and mixing both quantitative and qualitative methods in a single study or a series of studies to understand a research question. Quantitative research, appropriate for hypothesis testing, will be used in this study. Hypothesis testing determines if there is a relationship between two variables. Is there a relationship between standardization-stratification and student achievement? If there is a relationship, how does that impact the achievement and opportunity gaps for categorical subgroups? Qualitative research is appropriate for exploring a variable in depth, which is why I am using qualitative research to explore how districts have standardized-stratified their Career and Technical Education programs and how these programs are inclusive and equitable for subgroup students. By combining quantitative and qualitative methods, it will better inform and explain the research questions (Creswell & Guetterman, 2012).

Research Setting

According to Michigan's official education data source, MiSchoolData, the state of Michigan's K-12 enrollment for the 2022-2023 school year was 1,437,279. Michigan

has many rural areas in the north, particularly the upper peninsula, but a third of the K-12 population comes from the Detroit Metro area. Wayne, Oakland, and Macomb counties make up metro Detroit, which are the three largest counties in the state by population. These counties account for 551,253 of the state's K-12 enrollment. This study took place in Michigan's LEAs in counties that offered Career and Technical Education programs (Michigan Department of Technology, Management, and Budget, 2023; United States Census Bureau, 2021).

Wayne County has 34 LEAs that serve approximately 259,453 students, making it the most populous county in Michigan and the 13th most populous county in the United States. Wayne County is home to the largest school district in the state, Detroit Community Public Schools, with approximately 48,754 students, and the third largest school district, Dearborn Public Schools, with 20,145 students. The student demographics make the county the most culturally and linguistically diverse in the state. Of the 34 LEAs in Wayne County, 21 have state-approved CTE programs, with approximately 13,741 students enrolled during the 2022-2023 school year. According to the Postsecondary Taxonomy, which categorizes the majors available to students, the collective districts have 35 distinct CTE programs (Michigan Department of Technology, Management, and Budget, 2023; United States Census Bureau, 2021; CTEIS, 2022).

Oakland County has 31 LEAs that serve approximately 172,972 students, making it the second most populous county in the state. The largest school districts in the county are Rochester Community School District, with 15,042, and Troy School District, with 12,485. Of the 31 LEAs in Oakland County, 20 have state-approved CTE programs, with

approximately 17,017 students enrolled in 29 distinct CTE programs. Macomb County has 22 LEAs that serve approximately 118,828 students, making it the third most populous county in the state. The largest LEA in the county is Utica Community Schools, with 25,772 students, making it the second-largest school district in the state. Of the 22 LEAs in Macomb County, 18 have state-approved CTE programs (Michigan Department of Technology, Management and Budget, 2023; United States Census Bureau, 2021; CTEIS, 2022).

Typically, CTE targets student populations who would consider skilled trades occupations or schooling upon graduation. These counties serve distinctly different populations. According to 2021 U.S. Census data, Wayne County had a median household income of \$52,830, with 19.6% of its population living in poverty. Macomb had a median household income of \$67,828 with 11.6% poverty. At the same time, Oakland's median household income is the second highest in the state at \$86, 275 and poverty at 7.8%. In reviewing the number of LEAs participating in CTE in relation to the number of LEAs in each county, Macomb has approximately 85% of its LEAs offering CTE compared to Wayne and Oakland, with about 64% of its LEAs participating (United States Census Bureau, 2021).

Table 3.0 shows CTE enrollment by county with a breakdown by ethnicity, students with disabilities (DSB), students receiving free and reduced-price lunch (Econ), and students with limited English proficiency (LEP) for the 2021-2022 school year (Michigan Department of Technology, Management, and Budget, 2023).

Table 3.0***CTE Demographics Based on 2021-2022 Student Enrollment***

CEPD	Total Enrolled	M	F	Amer Ind	Asian	Black	Hisp	White	Mul	DSB	Econ	LEP
Macomb (40)	14,158	8049	6109	35	740	2048	494	10,381	460	460	5929	944
Oakland (39)	17,017	10,204	6813	27	1312	2716	1168	11,212	582	1513	4504	711
Wayne (41, 42)	13,741	7945	5796	34	640	3294	1291	8162	318	1379	6624	1504

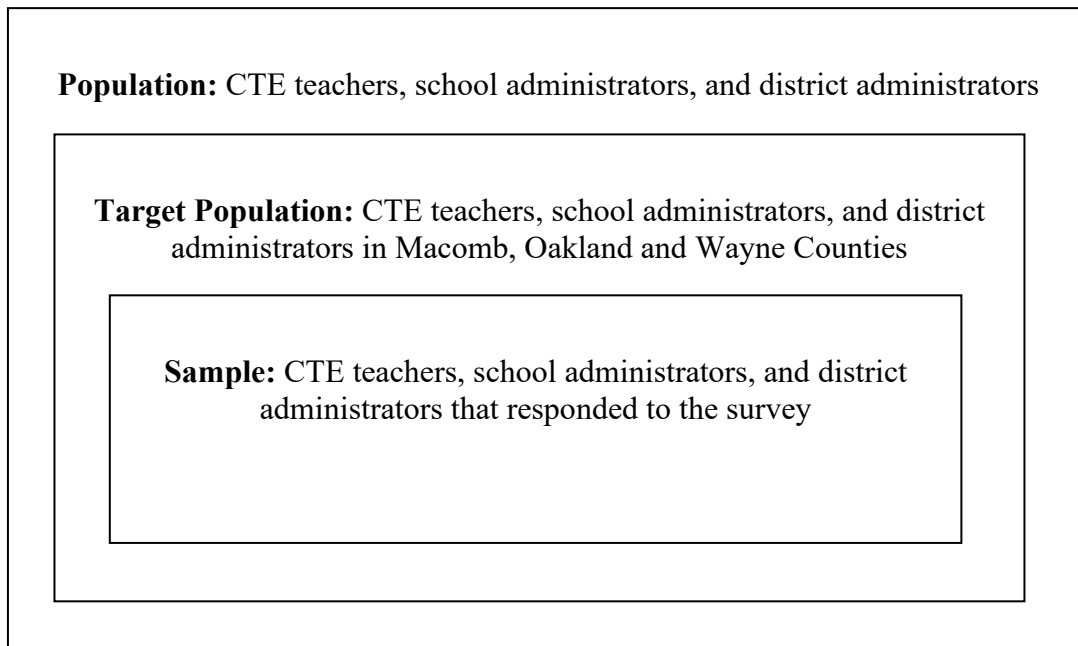
About 44,915 students were enrolled in CTE across all three Counties, with about 58% identified as male and 42% identified as female. Oakland County had a larger total of 17,017 students enrolled than Macomb and Wayne. Wayne County has the largest enrollment of economically disadvantaged and limited English proficient students and the lowest total enrollment (Michigan Department of Technology, Management and Budget, 2023; CTEIS, 2022).

Participants

This study used the cross-sectional survey design by sampling from the target population to generalize the results to the target population. Sampling determined the participants for this study. Figure 3.0 shows how the population was narrowed down to the sample by applying Creswell's design for sampling (2019, p. 390).

Figure 3.0

Differences Between The Population, Target Population, and Sample



The target population identified for the study were CTE teachers, school administrators, and district administrators in Macomb, Oakland, and Wayne County LEAs. The target population from the original research design was changed to the total population of CTE teachers, school administrators, and district administrators in the state. Initially, the change occurred because I was able to access the contact information for all of the Career Education Planning District (CEPD) Directors in the state. The idea of collecting more data ensured that I would have a robust sample to perform the statistical analysis for the study. Further into the study, I realized that the minimum response criteria from the original research design were not going to be achieved, so I strived to obtain a larger overall sample size.

The target population that responded to the survey was the sample population of 201. The original research design required a minimum of 30 districts to participate, with a minimum of 10 districts from each county. Of the 201 surveys collected, 23 districts and 27 intermediate school districts (ISD) participated. The ISDs responded on behalf of their LEAs because the ISDs operated the CTE programs at their career centers. The original design required 10 districts from each county, but I did not take into account that some counties did not have 10 districts with CTE programs. Macomb County was the only district that met this criteria, with 16 districts. The original design required responses from each role. However, the ISDs did not have a school administrator role; their role was more of a district administrator. For the three counties identified from the original research design, Wayne County had only one survey response, Macomb County had 16 districts with 116 responses, Oakland county had three districts and 1 ISD with nine responses. Since the minimum number of responses from the original design could not be met, I changed the design to include all of the surveys that were completed, which was 180.

Data Collection Instruments

In order to examine the research questions multiple data sources were used. For the quantitative portion of the study, a CTE survey collected participant's perceptions on the adherence to standards, tracking students into CTE programs, and how students' gain access to CTE programs. Additionally, the Career and Technical Education Information System (CTEIS) public database to collect student achievement data for reading, mathematics and science. For the qualitative portion of the study,

interviews were conducted to collect participant's feedback on the quantitative results of the CTE survey.

Survey Design

I identified key indicators of a standardized and stratified education system from the literature review to develop the survey items and aligned them with the Perkins V indicators. I developed an electronic survey using Qualtrics to collect perception data from CTE teachers and administrators. The survey instructed respondents to use a 10-point Likert-type scale, where zero disagreed and 10 agreed, to indicate their level of agreement with a series of statements. The survey also collected data on the selection criteria used to track students into CTE programs. For this question, participants were asked to select all that applied to their school from a list of possible criteria.

Demographic information collected from survey participants included the name of their school district, the city in which their school district resides, the number of years employed in education, their CTE role (teacher, school administrator, or district administrator), and the number of years employed in their CTE role. Participants who selected the "Teacher" role were also asked to select the Career Cluster(s) associated with their role (see Appendix E).

The survey constructed for this study used three distinct constructs: standardization, stratification, and access. "A construct is an attribute or characteristic expressed in an abstract, general way" (Creswell & Guetterman, 2019, p. 113). Each question indicated a distinctive feature representative of highly standardized-stratified systems (see Appendix G). The survey began with participants giving consent to

participate by reading and signing the Information Sheet for Exempt Research (Appendix F). The survey consisted of 14 questions; nine questions addressed the standardization of programs, four questions addressed stratification, and one question addressed access. The survey concluded with the final question, asking respondents to participate in a follow-up interview. If participants agreed to participate in an interview, they were asked to provide an email address. Table 3.1 maps the survey questions to the constructs and the Perkins V Program Indicators from the CTEIS public database.

Table 3.1*Survey Items Mapped to Constructs and Perkins V Program Indicators*

Construct	Survey Items	Perkins V Indicator
Standardization	1. My CTE program uses the National Career Cluster Standards	2S1: Academic Proficiency in Reading/Language Arts
	2. The standards in my CTE program integrate the Michigan High School Content Standards when appropriate	
	3. I use state/national standards in my CTE program to develop outcomes for student learning	
	4. My students are knowledgeable about the standards used in my CTE program	2S2: Academic Proficiency in Mathematics
	5. I use state/national standards to plan for instruction	
	7. I use assessments to measure the degree to which my students have met the state/national standards	2S3: Academic Proficiency in Science
	8. I grade my CTE students on the degree to which they have met the standards	
	9. My CTE program of study aligns with the technical skills needed to achieve a credential	3S1: Post-Program Placement
	10. My CTE program of study aligns with the content needed to achieve a credential	
		5S1: Program Quality - Attained Recognized Post-Secondary Credential
Stratification	6. I group my students by ability within my CTE classes	5S4: Program Quality - Other
	9. Did your students participate in pre-vocational programs	
	10. At what grade level did your students participate in pre-vocational programs	
	11. At what grade level can students enroll in your CTE program	

Table 3.1 - Continued*Survey Items Mapped to Constructs and Perkins V Program Indicators*

Construct	Survey Items	Perkins V Indicator
Equity	Select criteria used when placing students in CTE programs: ● Application process ● Prerequisite coursework ● Placement tests ● Prior academic performance ● Teacher recommendations ● Parent endorsement ● Student interest ● Family Member of current/past CTE student Other (write in response)	5S4: Program Quality - Other

Interview Design

Participants that agreed to be contacted for an interview were sent an email with a list of dates and times to choose from (see Appendix J). Once the participants confirmed their date and time for the meeting, I emailed them a link to the online meeting. I conducted the interviews on Zoom and the audio recording feature was used to obtain a software transcription of the meeting. After the meeting ended the transcription was available to download.

Once participants were welcomed into the meeting and introductions were made, I advised the participants that the meeting was going to be audio taped. I used a PowerPoint to guide the meeting (see appendix K). First, I reviewed the agenda to set norms for how the meeting would be conducted. I showed slides with the significant research findings, the selection criteria that was used for the access variable, messages about CTE for families from the literature, and findings from the literature regarding

adherence to standards. After I read each slide allowed, participants were asked to share their thoughts.

Data Collection

To elicit participants for the study, the MISD CEPD Director volunteered to distribute the survey to all of the CEPD Directors in the state of Michigan. The CEPD Directors received an email asking them to forward it to the CTE teachers, school administrators, and district administrators of the districts in their regions (see appendix I). The email invited them to participate in a short survey about CTE. A link to the survey was provided in the email. The link took participants to the CTE survey on Qualtrics. Due to low response rates from teachers, I emailed the same invitation to all of the CEPD Directors. I also gathered the email addresses of the CTE teachers from school district websites, where available, and sent the same email to them (see appendix H). The original survey design indicated the survey would be open for 3 weeks. Due to holidays and slow response rates, the survey was open for a total of 20 weeks. About every 3-4 weeks, participants received an email reminding them to participate in the survey. The estimated length of time to complete the online survey was about 10 minutes.

Data Analysis

I conducted an item-total analysis to determine the reliability and internal consistency of the survey. In order to test if there were shared constructs or factors for the survey items, I conducted a principal components factor analysis with varimax rotation. Factor analysis is a method used to assess the variability among observed, correlated items with the goal of identifying a lower number of underlying constructs. For example,

between 10 items measured, there may be as few as one and as many as 10 different underlying constructs. Principle components analysis estimates an eigenvalue solution to the multivariate equation suggested by the matrix made up of the survey items as variable and retains as potential groupings any eigenvalue greater than 1. The analysis then conducts a mathematical shift to maximize the variance between the retained solutions by re-estimating the vectors as orthogonal. The results of this analysis provide two critical pieces of information. (1) the number of underlying constructs measured by the items tested, and (2) the association (a correlation coefficient) between each item and that underlying construct. The second piece of information provides the text correspondence to the unmeasured construct needed to create a new name for the construct. I conducted a test-retest reliability to determine if the instrument has temporal stability consistency over multiple assessments (Cronk, 2012)

Based on previous research, it was reasonable to predict that students exposed to highly standardized-stratified systems would yield higher student achievement. To address the research questions, I hypothesized that CTE programs identified as highly standardized-stratified would have higher overall student achievement as measured by the Perkins V indicators and smaller achievement gaps among gender, ethnicity, and social class.

Hypothesis testing was used to determine if there is a relationship between the three constructs and student achievement, as stated above in my hypotheses. The first analysis, ordinary least squares (OLS), builds on the correlational association between two continuous variables and uses calculus to solve the least-squares-distance estimation

to find the best-fitting line, minimizing the distance between all observed points. As such, this analysis provides two critical points of information: (1) the strength of association (R) and its related amount of variance explained by the predictor R^2 and (2) the amount of estimated linear relationship between predictor and outcome (B). Regression analysis also supplies each estimate with an associated significance to determine the extent to which the observed estimate could have occurred by chance. For this analysis, I use the standard alpha level of .05 to argue for significance. However, I also consider the size of the relationship in an educational context to consider the “educational” significance in a meaningful way.

The second analysis determined if there is a relationship between the degree of standardization-stratification and student achievement. Based on the frequencies of each construct, I developed cut points for low, medium, and high. Recoding variables means changing the values of the variables by assigning new values to the existing ones, allowing one to manipulate the data to suit the needs of the analysis better. Using the new variable, I will conduct a one-way ANOVA. This analysis compares the size of differences observed among means between groups (the mean square distance between groups) with the difference of each observation from its group mean observed within each group (the mean square distance within groups). As such, this analysis determines whether at least one group differs significantly from any of the others. If the *F*-test identified significant differences overall, I further examined the individual contrasts between groups in a post-hoc comparison using the Fisher Least Square Distance (LSD) test.

For the follow-up interviews, the meeting transcriptions were analyzed to identify recurring themes that gave insight into how Michigan's CTE programs implemented and adhered to academic standards, and how students gained access to CTE programs.

Conclusion

CTE focuses on providing students with real-world skills and practical knowledge, but there are gaps in research regarding standards and tracking specific to CTE programs. More comprehensive studies could help establish a standards framework tailored to enhance the effectiveness of CTE. This dissertation aims to understand how a systems approach of adherence to educational standards and tracking affects student achievement outcomes. It further aims to explore access to programs and the impact on categorical subgroups, contributing valuable insights to the existing body of research in these areas

CHAPTER FOUR

RESULTS

As described in Chapter Three, this study used a mixed methods approach using data collected from the CTE survey and focus group interviews from the survey respondents. This chapter describes the research findings relevant to the goal of the study, which was to examine the relationships between the degree of standardization-stratification and student achievement and equitable access to programs in Career and Technical Education across Michigan. Through this investigation, I further studied how districts have standardized-stratified their programs.

Construction of the Measures

I conducted a confirmatory factor analysis to determine if there were shared underlying constructs for the group of survey items. In making the decision concerning whether items measure the same underlying idea, correlations greater than 0.7 are considered desirable and correlations less than 0.3 are considered weak. Table 4.1 shows the results of this analytic process. In the table, the correlation of each item with its associated construct is shown, with “standardization” in the first column, “stratification” in the second column and “access” in the third column.

Table 4.0*Results of Confirmatory Factor Analysis on Items Measuring Standardization,**Stratification and Access in Career and Technical Education*

Survey Items	Standardization Construct	Stratification Construct	Access Construct
I grade my CTE students on the degree to which they have met the state/national standards	.763		
I use state/national standards in my CTE program to develop outcomes for student learning	.739		
I use state/national standards to plan for instruction	.737		
I use assessments to measure the degree to which my students have met the state/national standards	.690	.423	
My CTE program of study aligns with the technical skills needed to achieve a credential		.879	
My CTE program of study aligns with the content needed to achieve a credential		.823	
Selected Choice: Prior Academic Performance			7.32
Selected Choice: Application Process			.718
Selected Choice: Teacher Recommendations			.680
Selected Choice: Placement Tests			.507
Eigenvalue	2.146	1.333	2.433
Percent of variance explained	53.655	13.330	27.029

Table 4.0 shows these data revealed four survey items were measuring the standardization construct (*Eigenvalue* = 2.15, % *variance* explained 53.7), three were measuring the stratification construct (*Eigenvalue* = 1.33, % *variance* explained 13.3), and four were measuring the access construct (*Eigenvalue* = 2.43, % *variance* explained 27.0). The measures for each construct were made into a new variable, one measuring each construct.

Relationship Between Constructs

To determine if there was a relationship between the variables, I conducted three simple linear regressions. The first was calculated to predict standardization based on access to CTE programs. A significant relationship was found ($F(1,110) = 11.328, p = .001$), with an R^2 of .093. On average, standardization increased by 2.8 units for every unit increase in access. Therefore, the access variable was positively related to standardization. In other words, the more selection criteria used to enter CTE programs, the higher one can predict levels of adherence to standards.

The second analysis was calculated to predict stratification based on standardization. The regression equation was not significant ($F(1,19) = 9.48185, p < .05$) with an R^2 of .081. For these data, stratification was not a predictor of standardization.

The third analysis was calculated to predict access based on stratification. The regression equation was not significant ($F(1,29) = 1.06232, p < .05$) with an R^2 of .030. For these data, access was not a predictor of stratification.

Relationship Between Constructs and Student Achievement

To determine if there was a relationship between the variables measuring characteristics of CTE programs and student and reading achievement, I conducted three simple linear regressions. The first was calculated to predict reading achievement based on standardization. The regression equation was not significant ($F(1,129) = 12.38744, p < .05$) with an R^2 of .000. For these data, standardization was not a predictor of reading achievement.

The second analysis was calculated to predict reading achievement based on stratification. The regression equation was not significant ($F(1,102) = 12.75044, p < .05$) with an R^2 of .001. For these data, stratification was not a predictor of reading achievement.

The third analysis was calculated to predict reading achievement based on access. The regression equation was not significant ($F(1,165) = 12.35891, p < .05$) with an R^2 of .017. For these data, access was not a predictor of reading achievement.

To determine if there was a relationship between the variables and mathematics achievement, I followed the same analysis pattern as used for reading achievement.. The first regression was calculated to predict mathematics achievement based on standardization. The regression equation was not significant ($F(1,126) = 11.16204, p < .05$) with an R^2 of .002. For these data, standardization was not a predictor of mathematics achievement.

The second was calculated to predict mathematics achievement based on stratification. The regression equation was not significant ($F(1,99) = 10.91991, p < .05$)

with an R^2 of .000. For these data, stratification was not a predictor of mathematics achievement.

The third was calculated to predict mathematics achievement based on access. A significant regression equation was found ($F(1,161) = 10.95457, p = .018.$), with an R^2 of .034. On average access increased by 2.0 units for every unit increase in mathematics achievement. Therefore, the access variable was significant in predicting mathematics achievement.

To determine if there was a relationship between the variables and science achievement, I again followed the process used for examining reading achievement. The first regression was calculated to predict science achievement based on standardization. The regression equation was not significant ($F(1,131) = 9.35643, p < .05$) with an R^2 of .004. For these data, standardization was not a predictor of science achievement.

The second was calculated to predict science achievement based on stratification. The regression equation was not significant ($F(1,103) = 9.85695, p < .05$) with an R^2 of .008. For these data, stratification was not a predictor of science achievement.

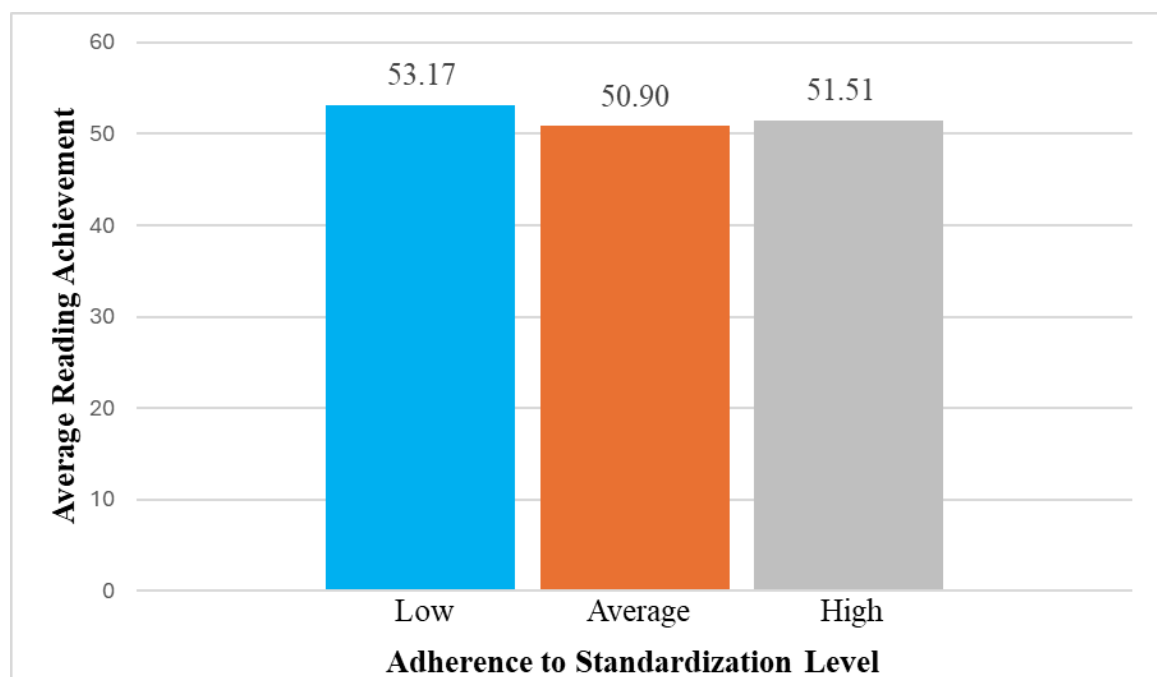
The third was calculated to predict science achievement based on access. The regression equation was not significant ($F(1,167) = 9.82558, p < .05.$), with an R^2 of .003. For these data, access was not a predictor of science achievement.

In addition to examining linear relationships between achievement and the characteristics of CTE programs, it was also important to investigate achievement relative to different levels of these measures to explore whether there may be non-linear

differences in achievement based on different levels of each characteristic. To conduct this analysis, I recoded the three independent variables using a range of old values to create cut points that identified low, average, and high levels of each characteristic. Using the new variables, I conducted a one-way ANOVA with the dependent variable reading achievement. Figure 4.1 shows the reading achievement means for the three groups, where 1.00 represents a low adherence to standardization, 2.00 represents average adherence, and 3.00 represents high adherence.

Figure 4.0

Reading Achievement Means by Adherence to Standardization Level

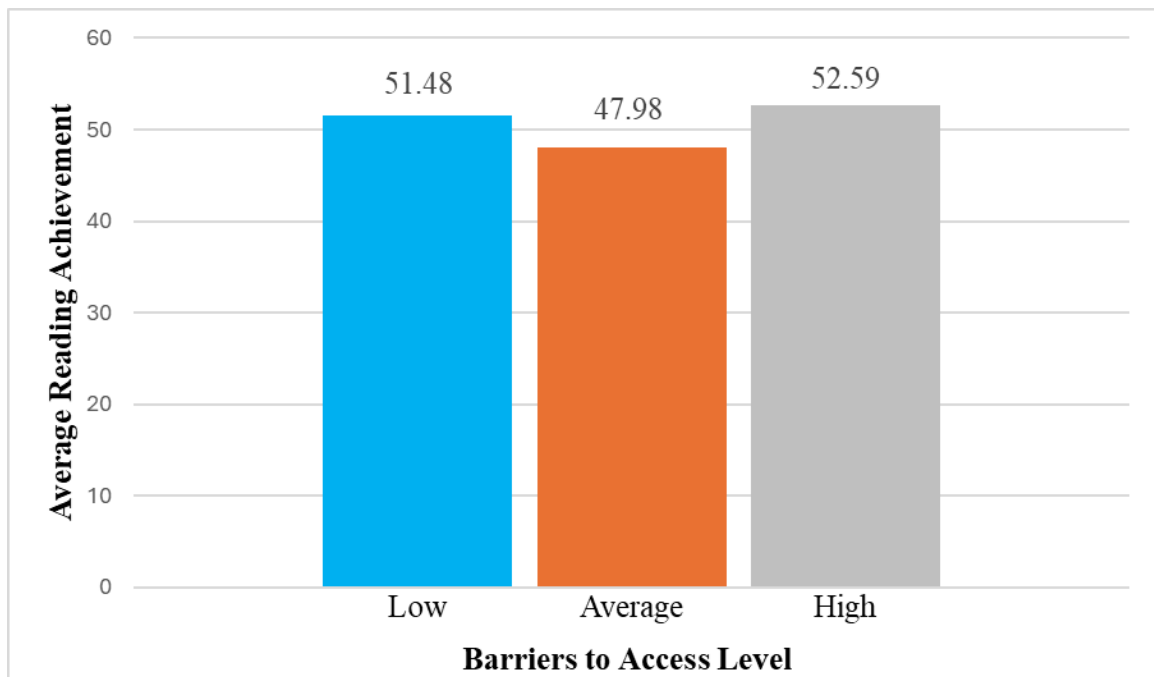


No significant differences were found ($F(2,128) = .344, p > .05$). Reading achievement did not differ significantly based on the level of standardization.

Figure 4.2 shows the reading achievement means for different levels of access, where again 1.00 represents a low number of barriers to access, 2.00 represents an average number of barriers, and 3.00 represents a high number of barriers.

Figure 4.1

Reading Achievement Means by Barriers to Access Level

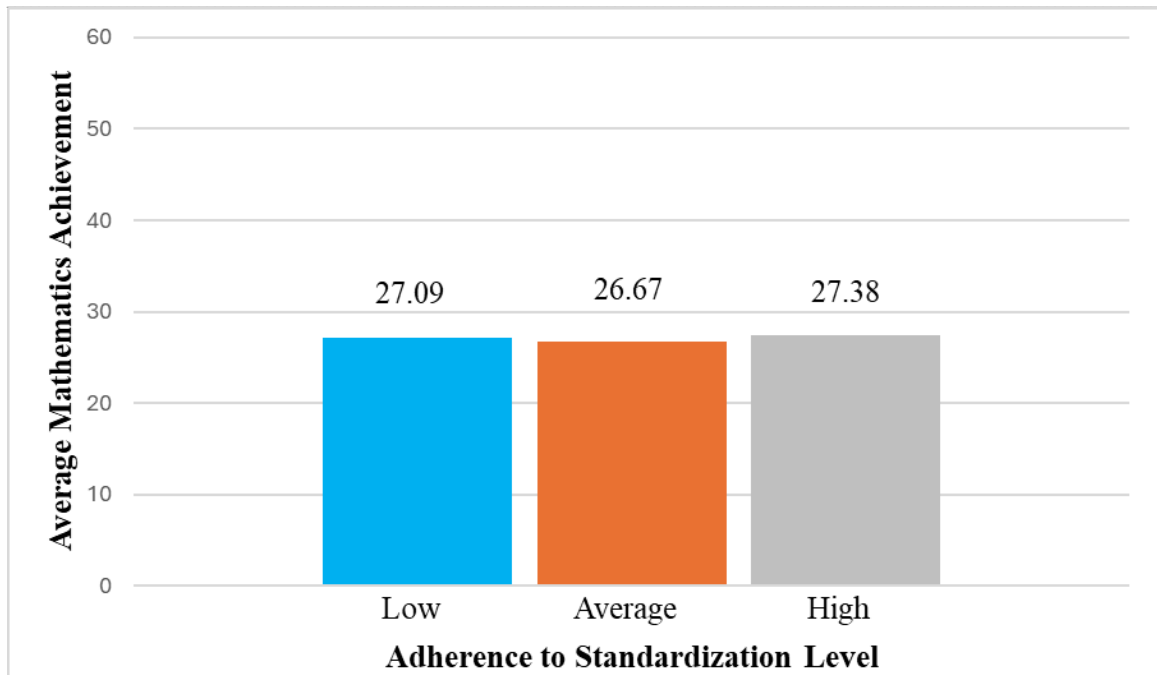


No significant differences were found ($F(2,164) = 1.449, p > .05$). Reading achievement did not differ significantly based on the level of barriers to access.

Figure 4.3 shows the mathematics achievement means for the three groups, where 1.00 represents a low adherence to standardization, 2.00 represents average adherence, and 3.00 represents high adherence.

Figure 4.2

Mathematics Achievement Means by Adherence to Standardization Level

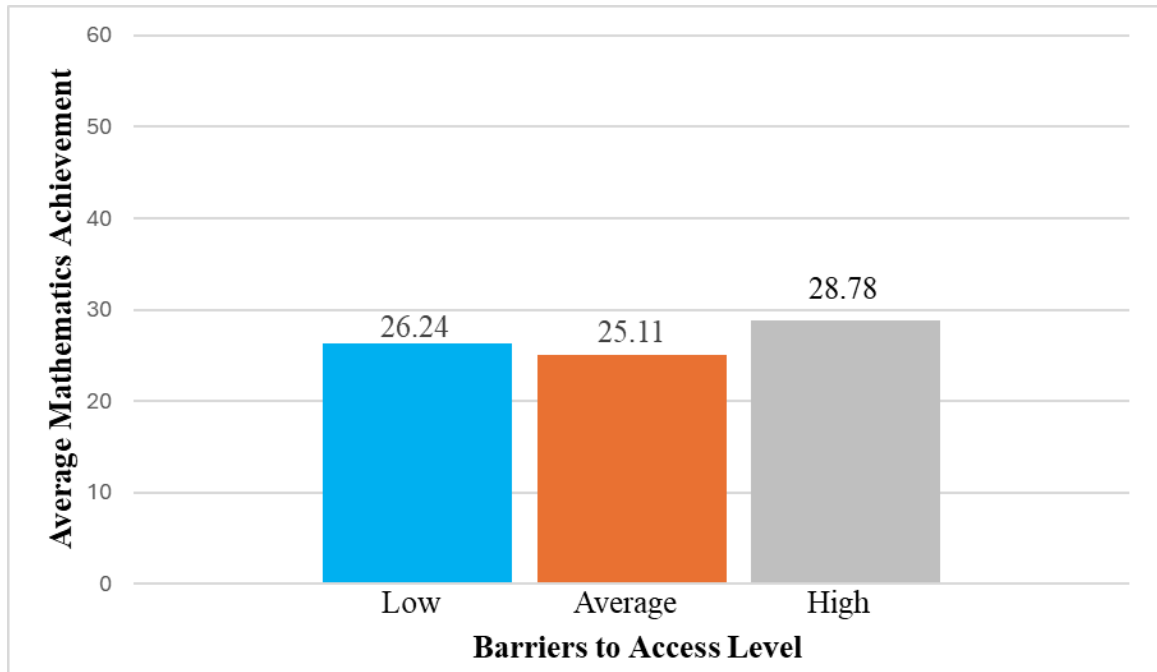


No significant differences were found ($F(2,125) = .035, p > .05$). Mathematics achievement did not differ significantly based on the level of standardization.

Figure 4.4 shows the mathematics achievement means for different levels of access, where again 1.00 represents a low number of barriers to access, 2.00 represents an average number of barriers, and 3.00 represents a high number of barriers.

Figure 4.3

Mathematics Achievement Differences by Barriers to Access Level

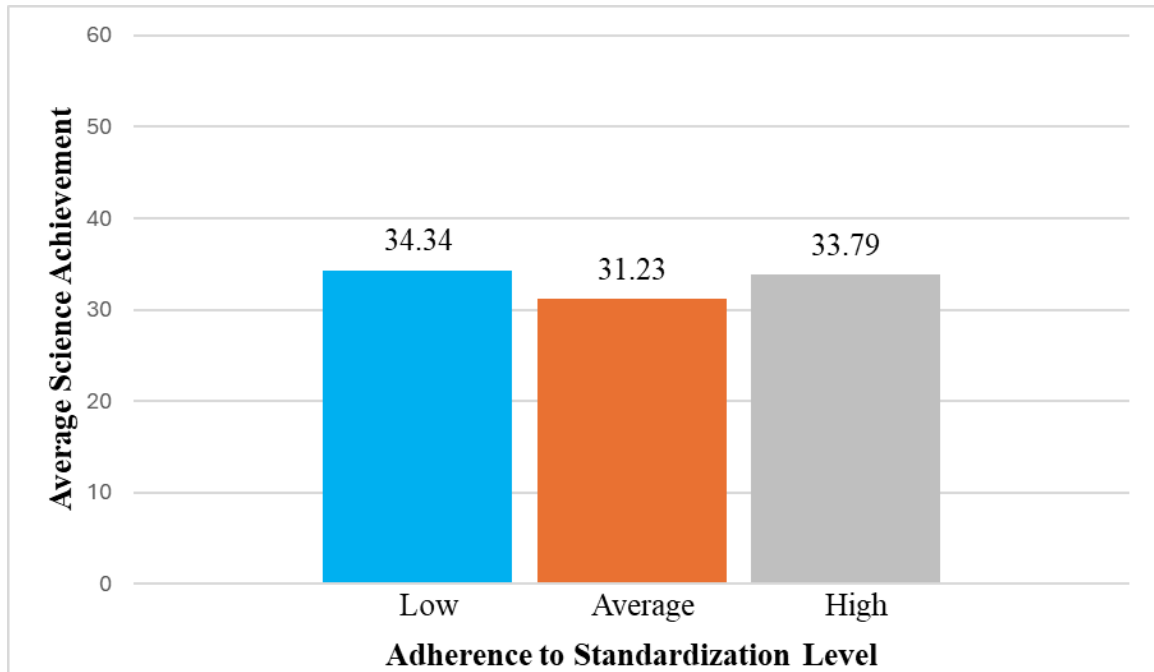


No significant differences were found ($F(2,160) = 1.251, p > .05$). Mathematics achievement did not differ significantly based on the level of barriers to access.

Figure 4.5 shows the science achievement means for the three groups where 1.00 represents a low adherence to standardization, 2.00 represents average adherence and 3.00 represents high adherence.

Figure 4.4

Science Achievement Means by Adherence to Standardization Level

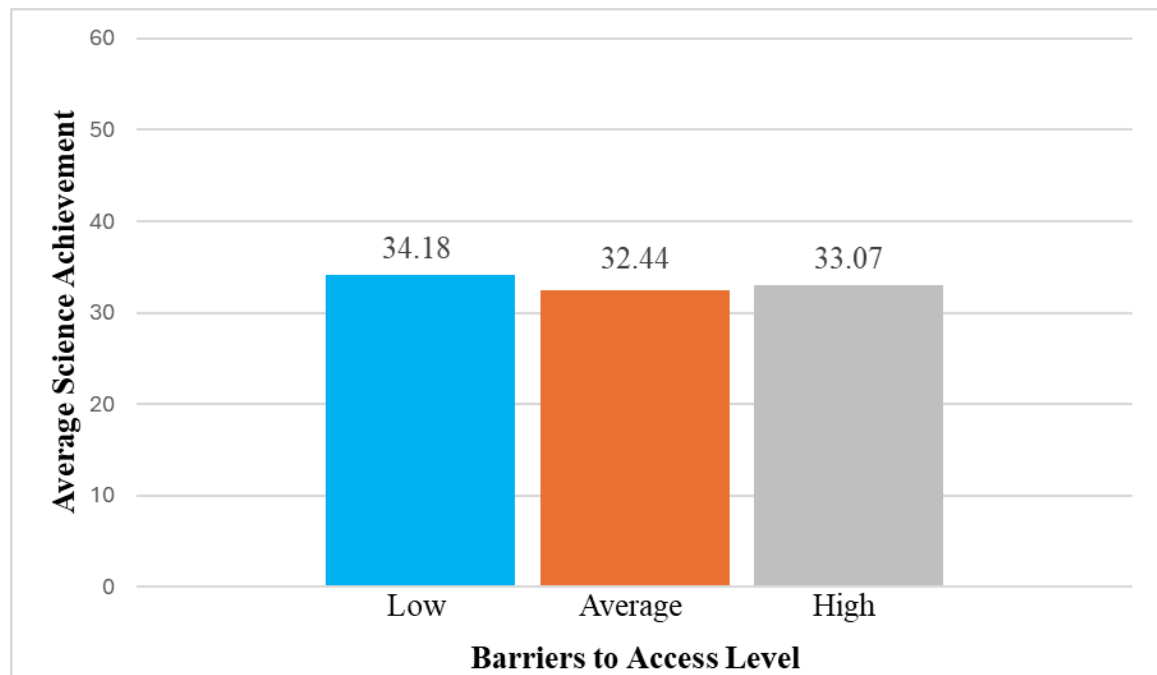


No significant differences were found ($F(2,130) = 1.035, p > .05$). Science achievement did not differ significantly based on the level of standardization.

Figure 4.6 shows the science achievement means for different levels of access, where again 1.00 represents a low number of barriers to access, 2.00 represents an average number of barriers, and 3.00 represents a high number of barriers.

Figure 4.5

Science Achievement Means by Barriers to Access Level



No significant differences were found ($F(2,166) = .448, p > .05$). Science achievement did not differ significantly based on the level of barriers to access.

Qualitative Findings

I conducted three focus group interviews with five survey participants via video and audio recorded Zoom meetings. Each focus group was assigned a letter (Group A, Group B, and Group C) for the purpose of reporting the data. All interview participants selected the role of teacher on the CTE survey. I used a PowerPoint presentation to share findings from this dissertation and from the literature review to effectively engage participants and facilitate reflection on the findings. The presentation allowed for visual support and structured guidance during discussions. Participants shared their personal experiences and knowledge during the interviews which allowed for deeper insights into the topics being

studied. This method established trust and rapport among participants, encouraging more open and detailed responses.

Standards and Access

I initiated each interview discussion by sharing the significant research finding from the simple linear regression predicting standardization based on access. Participants were then asked to share their thoughts about the research finding.

Group A stated,

“For me its engineering and we’re starting to get kids in there, those that can be anywhere from students who are on the certificate track (IEP), AP (advanced placement), 504s, anybody. And a big thing we’re seeing is a lot of students who struggle with math concepts or writing or science. We give them practical application of these things and they really see a lot of success.”

“I think that differentiated piece where how do you teach someone who is on a certificate track and also to someone who is a highflyer. Are we sticking to academic standards or are we kind of trying to only hit the middle or just doing the bare minimum so it’s accessible for the majority, but maybe not great for our opposite ends of the spectrum.”

When asked about adherence to the state and national standards. Group B stated,

“A gap analysis, there are 12 segments of instruction. And those 12 segments of instruction have to be delivered in order for the student to be considered a completer in that course.”

“If they have completed the competencies then they can move to the second year. If they haven’t completed the competency...we do not allow them to go any farther, you have to be able to do it.”

“It’s important for us to make sure they’re completing certain number of courses because it’s about funding moving forward for next year.”

To explore the selection criteria, I clarified that the access variable included prior academic performance, application process, teacher recommendations and placement tests. Participants were then asked if any of these criteria were used in their programs and

to share their thoughts about the criteria. Initially all three groups responded that their programs did not use selection criteria. When I asked what would happen if the number of students wanting to participate in CTE exceeded the number of seats available. Then participants were able to discuss the selection process used for their programs. In general participants did not have a clear understanding of the process because they are not involved in the decision making. Participants also stated that their programs are typically at capacity. Group A stated,

“Academic performance as a selection criteria can sometimes be almost a double-edged sword. We’ve seen both sides of it. Where a student who has not done well in their typical classes at a high school come out to the career center, they find something they’re really passionate about and they’re just a completely different student.”

“I think poor academic performance could be an indicator of success at the career center. But it could also sometimes weed out student that would be really successful here.”

When discussing teacher cadet programs Group C stated,

“Prior academic performance does matter. If your grades so far have been mediocre, we don’t even care so much about mediocre. It’s the failing, right... We do have an application process. There’s a form that you fill out. And there’s a little paragraph typed up. We used to have two teacher recommendations, but that went away during COVID.”

For other programs Group C stated,

“ They’re not doing well; they’re C or D students in like math and English. But they get into our classes, and they thrive. Because it’s hands-on. They understand what they’re doing and it’s really incumbent upon us as the teachers to tie in math. It’s really about trying to make that connection between the work that they’re doing in this class and that they think they don’t really need math anymore.”

To further explore access to the programs, I shared findings from the research of Advance CTE (2021) on overarching messages that resonated with diverse students and

their families. The messages included: “preparing for the real world”, “making connections with peers, instructors, and employers with similar interests”, and “opportunities to take classes that focus on gaining skills in a specific field.” From this study, I also included findings on the aspects of the education experience that were a high priority for students and their families. These included: “career exploration”, gaining skills”, “getting hands-on experience”, “finding a career passion”, “finding the right-fit”, and “CTE prepares learners for college and career success.” Participants were then asked to share their thoughts about the research findings.

All three groups shared transition strategies for incoming freshman that used current CTE students in leadership roles giving tours and talking about their CTE programs and experiences. Participants also discussed the continued engagement of graduated CTE students coming back to share their post-secondary experiences. These were found to be successful marketing strategies, and they felt they were using some of the suggested messages from the Advance CTE study. Through the discussion it was noted that the high school counselors communicated the most with students and families about CTE. All three groups stated high school counselors were not educated on CTE and often created barriers for students entering the programs.

Group A stated,

“ One of the things that we as a center are trying to do more is really push the college piece. We’re still fighting that kind of stereotype of a CTE student as like the student that’s not going to go to college. They need to just get these skills so they can go get a job.” “...with my program specifically, you have to have a four-year degree”.

All three groups identified the counselors as needing to learn more about their programs in order to effectively communicate with students and parents.

Group A stated,

“Sometimes counselors are weeding out student who want to take my program because they think that there’s more value in a dual enrollment or an AP class. Where my class they get nine credits to Ferris State.”

“Our counseling department turned over three years ago. With our new counseling staff we’ve really had the chance to educate them on what CTE really is and we’ve had a lot of chances to dispel myths”.

When discussing messaging to diverse families about CTE and their access to programs

Group B stated,

“This year for Skills USA my students are doing a couple of projects. One project is for females in automotive and another one that’s for African Americans in automotive.”

Group A stated,

“I think it’s also about breaking stereotypes in general. I’m in a very male dominated area. Let me correct that. I’ll say a white male dominated industry. One of my big things over the last four years is to get more girls into engineering and the need is there. Like they (girls) want to do it. But they’re so often told, don’t do that. That’s a man’s job.”

To further explore the adherence to standards, I shared findings from the literature review stating 1.) Most CTE programs are not aligned with academic standards. 2.) Teachers believed that CTE learning standards improved rigor, credibility, and parity with academic courses and attracted high-performing students to their classes. However, they reported that CTE standards were not consistently implemented. 3.) The route CTE teachers take to obtain certification may be lacking in training on academic standards

(Kim et al., 202 and Castello et al., 2007). Participants were then asked to share their thoughts about the research findings.

Group A stated,

“I actually apply a standard to every single assignment. I also do it to a lot of hands-on work. I’m observing student and applying the data they way it gives me a lot more information about student and their progress.”

“ I’m the only person in my county that teaches this. So, I heavily rely on my statewide teacher organization. We (organization) are the only ones that have done the curriculum work and dissected all of the competencies. Not every program has a strong professional organization to do that.”

Group B stated,

“We (CTE teachers) do have crosswalks that we have done multiple times over the decades which is why our students are given I believe English, foreign language and math credit for obtaining our completer status.”

Group C stated,

“When we went from the gap analysis of Perkins core competencies, we had to align our competencies with the academic standards, so that it was listed there. That’s why we are held to those standards.”

The focus groups consisted of four teachers who completed a teacher education program of which three had CTE certification and 1 teacher on a career authorization.

When discussing the teacher educator pathway and the annual career authorization pathway to Michigan teacher certification Group A stated,

“I hope that somehow as a state, we could build a support network for those kinds of teachers (annual career authorization).”

Group B stated,

“How do you balance getting an educated, experienced CTE teacher. So maybe the solution is that you block schedule your CTE classes. You co-teach them with a math teacher.

Group C stated,

“We have our mentorship program that we do with our teachers. We talk to them every single day. We share lunch. We share preps, so that when we have questions they understand, they get the answers that we need.”

CHAPTER FIVE

DISCUSSION

This study examined the relationship between and among the variables: standardization, stratification, and access. Additionally, the study used unstructured interviews using a PowerPoint presentation of topics to gather in-depth information surrounding the research findings. First, the study investigated the relationship among the variables to determine if one variable could predict changes in another variable. Second, the study investigated the relationship between each variable and student achievement to determine if changes in one variable are associated with changes in another. Understanding the relationship between and among the variables enables practitioners to make informed decisions. Last, the study explored the practical application of the selection criteria and adherence to standards.

This study followed a mixed methods approach using survey perception data analyzed quantitatively. The survey collected data from 26 ISDs and 23 LEAs across the state of Michigan. A total of 180 participants completed the survey online. Participants included CTE administrators, principals, and teachers. Interviews were conducted with five teachers of CTE programs that completed the CTE survey. The research questions that guided this study focused on equitable access to CTE programs.

To understand the significance of this study, one must refer back to the theoretical framework discussed in Chapter One. People in a society agree to mutual rights and responsibilities. These rights and responsibilities establish governance. Political theories

of justice assert the belief that all citizens are afforded the same basic rights to the most extensive total system. One must acknowledge that exclusion is based on the interconnected nature of social categorizations is an acceptable standard in the United States, highlighting the importance of this study to ensure equitable access for all students. In this chapter, I will discuss insights and interpretations of the study. First, I will review the findings from the research and discuss the implications of the findings. Next, I will address the limitations of the study and propose areas for further research. Finally, I will conclude with implications for practitioners in the field.

Review of Findings

A qualitative review of the selection criteria uncovered that access to CTE programs is being mediated by the selection criteria, thus controlling the access. Therefore, access is maintained through the power of the selection process. From the literature review in Chapter 1, another aspect of access control is the recruitment of students. Kim et. al. (2021) argues that access begins with informing students and families about CTE programs and, more importantly, explaining how these programs align with future career pathways and wealth.

As presented in Chapter 4, results from the analysis of the relationship among the variables showed a statistically significant relationship with the access variable predicting the standardization variable. Results from the analysis of the relationship between each variable and student achievement showed a statistically significant relationship with the access variable predicting mathematics achievement. These two relationships were the only significant ones found in the study.

Selection Criteria and Program Access

It is important to understand what the access variable is measuring in terms of the survey construction and responses from the participants. In the survey, participants were asked to identify the selection criteria used to track students into CTE programs. Each selection criteria created a barrier to accessing the program. The criteria identified by the survey responses included prior academic performance, the application process, teacher recommendations, and placement tests. Due to the selection criteria, CTE programs are not necessarily available to all students but rather to students who fit the criteria. Since the criteria are based on student achievement, students with higher academic performance have more access than students with lower academic performance.

Thinking about how the selection criteria are implemented Group A shared,

“We have one program, our health science program. There’s been talk about because they’re so full. There’s so much interest that they may be moving to some sort of an interview process or an application. I won’t say merit-based but maybe more skill-based or more academic-based. Where there would be some selection criteria.”

Group B further clarified,

“If a counselor sees someone with a very low grade point average, they’re going to tend to put them in CTE. Maybe not health science, but definitely construction trades, automotive body, or welding.”

These findings support the argument that the selection process acts as a filter to identify more academically adept students, resulting in disproportionate demographics in CTE programs.

It is of the utmost importance that CTE programs are not limited to particular student demographics to prevent the program from becoming exclusive. Thus, removing

the selection criteria ensures more equitable outcomes for students who are likely to benefit from CTE and a more diverse experience benefiting all students. CTE administrators and teachers should regularly review program demographics to account for underrepresented populations based on race, gender, ethnicity, socioeconomics, and students with disabilities. While discussing diversity, Group C stated,

“This is my first year not having a teacher (cadet) of color. I’ve had at least one or two every year. I do not have one this year. I also have two males... Next year I have five signed up for the first time. And that’s exciting.”

Recruitment and Program Access

Advanced CTE (2021) conducted studies to determine effective messaging to classification subgroups. The top message that appealed to White, Black, and Latinx families was “preparing for the real world.” The message that appealed to the above demographics, including low-income families that reflected the benefits of CTE programs, was “Making connections with peers, instructors, and employers with similar interests.” The top two additional messages appealing to current and prospective students and their families were “opportunities to take classes that focus on gaining skills in a specific field and opportunities to take classes that allow you to explore different careers of interest.”

A common theme among the groups interviewed was connecting current CTE students with prospective CTE students to share their experiences in CTE. This was typically done during the transition from middle school to high school and high school to post-secondary. Group C explained that CTE is a K-12 initiative. Starting in kindergarten they have students making pictures of what they think they want to be when they grow

up. “We’re preparing them for the CTE life all the way from the day they start school until they graduate.”

Another common theme was exploring different careers by hosting tours of the CTE classrooms and demonstrating the use of equipment in programs like automotive, construction trades and welding. Group C explained how this works.

“The middle school students sign up for it. They come down to the media center. They get an opportunity to work in my class. They get to work with the robots. They get to disassemble engines. They get to see some 3D printing and they’re putting their hands on some of these things.”

Historically, CTE programs were created to address the needs of the economy while giving students who were not necessarily college-bound opportunities for employment that would provide financial stability. In recent years, the high economic demand for skilled trade workers coupled with the shortage of qualified workers has led employers to offer more competitive wages. Therefore, the significant salaries associated with the trades have attracted students who may have otherwise gone to college, particularly those seeking careers in mathematics and science. The attraction of higher-performing students to CTE may account for the academically based selection criteria.

Coming out of the COVID pandemic, America identified a shortage of healthcare workers. During this time there were numerous reports in the media about the healthcare profession in general, post-secondary programs and the average salaries associated with various positions within the field. When schools returned to in-person learning, they began planning their medical science CTE pathway. As Groups A and B alluded to above, these programs are reserved for selected students. This is one example of how our education system supports the economic demands of the country.

Relationship Between Access and Standardization Variables

The results of the analysis showed a statistically significant relationship with the access variable predicting the standardization variable. The more access is controlled and maintained, the higher the degree of adherence to standards. Since access was based on academic achievement, one assumption is that teachers' perceptions of their students directly affect the expectations they set for them. Teachers unknowingly hold different expectations for students based on their demographic characteristics, potentially impacting their approach to teaching and the academic outcomes for students. (Tyson & Roska, 2016).

According to Meuret (2001) and restated by Kim et al. (2021), education does not have to be the same, but it must be worth the same. Equal worth means they have to have the same effects. The question then becomes whether a standards-based class yields the same worth as a non-standardized class. In a literature review, Kim et al. (2021) found that most CTE programs are not aligned with academic standards. Castello et al. 2007 found that teachers believed that CTE learning standards improved rigor, credibility, and parity with academic courses and attracted higher-performing students to their classes. However, they reported that CTE standards were not consistently implemented.

Teachers are often recruited from the industry to work in CTE programs. The route CTE teachers take to obtain certification may be lacking in areas proving critical in teaching students. The state's highly qualified teacher status for CTE is primarily based on the number of years employed in industry, not on the number of years teaching in a classroom. To support this finding Group A said,

“I think half of the teachers in our building have a CTE endorsement and the other half are from industry, where they’ve gone through zero formal teacher training.” “Of those people that actually have the endorsement, I want to say there’s only three of us that have gone through like actual teacher training.” “I have my full education credentials...I’m the only one...I’m one of maybe nine people in our county that has this high of a credentialing.”

As part of the traditional teacher preparation program, teachers learn to be conscious of their own biases and perceptions of students. Teachers learn to reflect on their practice and are expected to improve with years of service. Teachers are also taught methods of scaffolding, differentiating instruction, and strategies to increase achievement for students. These are critical areas of teacher education programs that cannot be overlooked. Discussing how teachers with an annual career authorization manage standards in the classroom Group A stated, “A vast majority of teachers... don’t know how to implement standards accurately.” Group B stated,

“I am on a career authorization. I’m a little different because I had a lot of experience teaching in the military, 15-16 years doing it in the military. So I understood standards, how to write lesson plans. So not everyone has the background that I have.”

Relationship Between Access and Mathematics Achievement

The results of the analysis showed a statistically significant relationship with the access variable predicting mathematics achievement. The more access is controlled and maintained; the higher one can predict mathematics achievement. One assumption is that students entering into the program may have higher math achievement upon entry. A common assumption is that CTE offers many programs of study based on careers in STEM, which may attract students who are adept in mathematics. Thus, mathematically adept students’ progress in an environment focused on mathematics. Another assumption

is that the selection criteria, placement tests and prior academic performance, are based on mathematics achievement. If students must attain a level of mathematics completion before entering into CTE, then one would expect higher math achievement.

The argument for this assumption would be the research of Bozick and Dalton (2013), which found that students demonstrated increased math achievement compared to their own achievement levels prior to enrollment. This finding supports the research of Heisig and Solga (2015), who found that a greater emphasis on CTE was positively related to numeracy skills and that gains were larger for lower performers. One conclusion could be that instruction may have an impact on math achievement.

CTE programs of study integrate rigorous academic content standards with technical skills standards in an authentic way. Students learn foundational academic knowledge and specific career-related skills through a connected and relevant learning experience. Teachers use project-based learning to give students opportunities to apply their skills in the real world. (Moyer et al., 2017; Wright, 2011 J.R Stone, 2014. These types of teaching methods are shown to increase student interest and engagement in the content being studied, thus increasing achievement. Prior to participating in CTE programs, students may have been disengaged from the traditional high school mathematics classroom, which consisted of lectures and repetitive practice. However, once they experience critical thinking and the application of skills to meaningful tasks, their learning has much more significance. Especially if they know it is connected to a career they aspire to obtain.

Recommendations for Practitioners

The following is a list of specific recommendations compiled from the literature review and analysis of the research data for CTE practitioners.

Program Access

- Incorporate the strong messages identified by Advanced CTE when communicating about CTE to students and their families (preparing for the real world, making connections with peers, instructors and employers with similar interests, opportunities to take classes that focus on gaining skills in a specific field, and opportunities to take classes that allow you to explore different careers of interest).
- Incorporate the attractive aspects of CTE identified by Advanced CTE when communicating about CTE to students and their families (career exploration, gaining skills, getting hands-on experience, finding a career passion, finding the right-fit, and CTE prepares learners for college and career success).
- Rebrand CTE marketing materials to align with the messaging and program design.
- Open access to all student demographics and ensure equitable outcomes.
- Review program demographics to account for underrepresented populations based on race, gender, ethnicity, socioeconomics, and students with disabilities.

Teacher Preparation

- Train teachers on reflective teaching practices centered on cultural proficiency and unconscious bias to build capacity for meeting the needs of diverse learners.

- Train teachers on methods of scaffolding, differentiating instruction, and strategies to increase achievement.
- Provide teachers with guidance on implementing the standards and integrating academic content standards with technical skill standards
- Incorporate opportunities for developing students' critical thinking and problem-solving skills in the context of project-based learning.

Leadership

- Develop the administrator's background in innovation and the future direction of career pathways being offered.
- Develop a strong school climate of cooperation

Limitations of the Research

Although this study was insightful, it is not without limitations. The first limitation was that the sample size may have decreased the power of the study. Although the sample size was sufficient for this study, I preferred a larger pool of participants so that researchers and practitioners could generalize the results to wider audiences. Due to the sample size, the data could not be disaggregated by CTE roles. As a result, all participants were examined as a whole.

The second limitation was that most participants came from the county where I work. This association may be due to the fact that I was the CTE administrator for my district from the fall of 2019 to the spring of 2022. During this time, I interacted with other CTE directors in the county, as well as the teachers in my district. Therefore, participant perceptions of me may have increased participation in the county.

The final limitation was the functionality of the survey. I had a few participants contact me because the survey was routing them to the wrong role or routing them to another role rather than taking them to the end of the survey. I reset the “go to question number,” which caused the survey to regain functionality. I emailed the participants, letting them know I fixed the survey. The interrupted functionality of the survey may have resulted in a decrease in participation because once people discovered it was not working properly, they may have lost interest in participating.

Future Research

This study found four selection criteria measuring the access construct: prior academic performance, the application process, teacher recommendations, and placement tests. A qualitative study is needed to determine how participants define each selection criteria, its role in the selection process, and its impact on access to CTE. Prior academic performance and placement tests are based on student achievement, which leads me to wonder if only students with high academic performance can access CTE. The application process and teacher recommendations are a means of narrowing down student candidates from a larger pool, leading me to question, What are the most effective ways for educators and administrators to achieve this goal while keeping access open? A qualitative study is needed to understand how the selection criteria shape enrollment for underrepresented demographics by posing barriers to enrollment and how the selection criteria and processes can be more equitable and inclusive.

To address equity and access, one must look at the point of program entry. Recruitment practices inform students and their families about CTE opportunities. Career

and Technical Education has been around since 1917, but many families still do not know about the program. In 2020, Advanced CTE commissioned the Siemens Foundation to conduct a qualitative study with parents, guardians, and students involved in CTE with an oversample of Black, Latinx, and low-income families. The study re-examined the messaging themes and resiliency of their 2017 study. The study found that 47% of prospective parents and students reported that they never heard of the term Career and Technical Education, and 68% had only heard of the term “vocational education” (Advanced CTE, 2022). The study identified messaging themes that appealed to students and their families. However, I could not find explicit research that applied the message themes and reported outcomes on the effectiveness of recruitment. Therefore, research is needed to determine adherence to the identified message themes and the relationships among and between the message themes, access to programs, and enrollment demographics.

I discovered through a review of the literature that alternative routes to CTE teacher certification may not address critical areas pertaining to equity, access, and the use of academic standards. A strong argument is made for extensive research on “the role of teacher implicit bias” on equitable outcomes for students, the alignment of CTE curriculum segments to academic standards, the consistent adherence to teaching academic standards and its impact on student achievement. “When considering the potential of culturally responsive and sustaining teaching practices to mitigate bias”, I pose the following question: What are the most critical outcomes for an alternative route to CTE teacher certification? Moreover, what specific areas of teacher preparation do

CTE teachers need ongoing training? (Kim et al., 2021; p. 25) Additionally, CTE needs more large-scale studies to estimate effects with higher precision and detect subtle effects that smaller studies cannot do. Few states have adopted a standards framework that has impacted CTE achievement; little research has addressed the inconsistencies in programs within and between districts and states.

Conclusion

CTE offers 13 career cluster pathways for students to explore and pursue in high school and post-secondary. Universities have seen a decline in enrollment, with more students entering the labor market and post-secondary vocational training programs. The increased demand for higher-skill workers suggests that CTE may be filling the opportunity gap. However, research shows that students and families are not always unaware of the CTE career pathways their school offers, which highlights the concern that our education is not meeting the demands of our economy. A review of the literature discovered that there was only a small number of existing empirical studies, signifying gaps in research to standards, tracking, and access to programs. CTE programs must recruit and select diverse students, especially since the United States is continually becoming more and more diverse. Embracing diversity strengthens our economy by preparing students for an innovative and competitive labor market.

Findings from this study show that the more access is controlled and maintained by the selection criteria, the higher adherence to academic standards and a higher increase in mathematics achievement. Administrators and teachers examine their selection criteria and processes to ensure students have equitable access to programs. It is also important to

identify the underlying factors that influence teachers' adherence to academic standards to enhance teacher effectiveness through professional development.

APPENDICES

Appendix A



Institutional Review Board

Date: September 27, 2023

Study #: IRB-FY2023-305

Study Title: THE IMPACT OF THE DEGREE OF STANDARDIZATION AND STRATIFICATION ON STUDENT ACHIEVEMENT, EQUITY AND ACCESS

Submission Type: Initial

IRB Decision: Exempt

Research Team:

Jennifer Hernandez

Julia Smith

Based on applicable federal regulations, the above referenced study has been determined to be Exempt, with the following categories:

Category 2.(ii). Research that only includes interactions involving educational tests (cognitive, diagnostic, aptitude, achievement), survey procedures, interview procedures, or observation of public behavior (including visual or auditory recording) if at least one of the following criteria is met:

Any disclosure of the human subjects' responses outside the research would not reasonably place the subjects at risk of criminal or civil liability or be damaging to the subjects' financial standing, employability, educational advancement, or reputation; or

Letter and Consent Document:

This letter along with the IRB approved (date-stamped) consent document can be found in Cayuse in the Submission Details page under Letters and Attachments, respectively. Please make sure to use the most recent IRB approved version of the consent form in consenting participants.

Permission from Research Sites:

Please note the following:

- This IRB exemption determination letter means that this research has met one or more of the federal criteria for exemption per 45 CFR 46.104- Exempt Research.
- Before the research is initiated, permission to conduct research at a given site must be obtained from all research locations listed in the IRB submission. You must keep copies of all such permission letters for your files.
- It is the responsibility of each researcher to follow all applicable policies and procedures of any outside institution where the research will be conducted.

Modifications:

Any changes to this exempt project must be reviewed by the IRB prior to initiation by submitting a MODIFICATION request. Do not collect data while the changes are being reviewed. Data collected during this time cannot be used in research.

Record Retention:

Exempt projects will be retained by the IRB office for three years after the last action on the project.

You are approved to start the research. Please retain a copy of this notification for your records.

If you have any questions, please contact the IRB office.

Thank you.

The Oakland University IRB

Appendix B

2020 Map of PISA Countries and Economies

OECD Member Countries		Partner Countries & Economies		Partner Countries & Economies in Previous Testing Cycles
Australia	Lithuania	Albania	Malaysia	Algeria
Austria	Luxembourg	Argentina	Malta	Azergaijan
Belgium	Mexico	Baku (Azerbaijan)	Republic of Moldova	Guangdong (China)
Canada	Netherlands	Belarus	Montenegro	Himachal Pradesh (India)
Chile	New Zealand	Bosnia & Herzegovina	Morocco	Kyrgyzstan
Colombia	Norway	Brazil	Republic of North Macedonia	Liechtenstein
Czech Republic	Poland	Brunei Darussalam	Panama	Mauritius
Denmark	Portugal	B-S-J-Z (China)**	Peru	Miranda (Venezuela)
Estonia	Slovak Republic	Bulgaria	Philippines	Tamil Nadu (India)
Finland	Slovenia	Costa Rica	Qatar	Trinidad & Tobago
France	Spain	Croatia	Romania	Tunisia
Germany	Sweden	Cyprus	Russian Federation	
Greece	Switzerland	Dominican Republic	Saudi Arabia	
Hungary	Turkey	Georgia	Serbia	
Iceland	United Kingdom	Hong Kong (China)	Singapore	
Ireland	United States*	Indonesia	Chinese Taipei	
Israel		Jordan	Thailand	
Italy		Kazakhstan	Ukraine	
Japan		Kosovo	United Arab Emirates	

Korea		Lebanon	Uruguay	
Latvia		Macao (China)	Viet Nam	

**Puerto Rico participated in 2015 as an unincorporated territory of the U.S.*

***B-S-J-Z (China) refers to Beijing, Shanghai, Jiangsu and Zhejiang provinces/
municipalities. Beijing, Shanghai, Jiangsu and Guangdong provinces/municipalities
participated in 2015*

Appendix C

2018 Performance Snapshot for Reading

Countries/ Economies	Reading (Mean)	Countries/ Economies	Reading (Mean)
B-S-J-Z (China)**	555	Jordan	419
Singapore	549	Malaysia	415
Macao (China)	525	Brazil	413
Hong Kong (China)	524	Colombia	412
Estonia	523	Brunei Darussalam	408
Canada	520	Qatar	407
Finland	520	Albania	405
Ireland	518	Bosnia & Herzegovina	403
Korea	514	Argentina	402
Poland	512	Peru	401
Sweden	506	Saudi Arabia	399
New Zealand	506	Thailand	393
United States	505	North Macedonia	393
United Kingdom	504	Baku (Azerbaijan)	389
Japan	504	Kazakhstan	387
Australia	503	Georgia	380
Chinese Taipei	503	Panama	377
Denmark	501	Indonesia	371
Norway	499	Morocco	359
Germany	498	Kosovo	353
Slovenia	495	Lebanon	353
Belgium	493	Dominican Republic	342
France	493	Philippines	340
Portugal	492	Spain***	m
Czech Republic	490		
Netherlands	485		
Austria	484		
Switzerland	484		
Croatia	479		
Latvia	479		
Russia	479		
Italy	476		

Hungary	476		
Lithuania	476		
Belarus	474		
Iceland	474		
Israel	470		
Luxembourg	470		
Turkey	466		
Ukraine	466		
Slovak Republic	458		
Greece	457		
Chile	452		
Malta	448		
Serbia	439		
United Arab Emirates	432		
Romania	428		
Uruguay	427		
Costa Rica	426		
Cyprus	424		
Moldova	424		
Montenegro	421		
Bulgaria	420		
Mexico	420		

***B-S-J-Z (China) refers to Beijing, Shanghai, Jiangsu and Zhejiang*

provinces/municipalities.

**** Missing data*

Appendix D

2018 Performance Snapshot for Mathematics

Countries/ Economies	Mathematics (Mean)	Countries/ Economies	Mathematics (Mean)
B-S-J-Z (China)**	591	Kazakhstan	423
Singapore	569	Moldova	421
Macao (China)	558	Baku (Azerbaijan)	420
Hong Kong (China)	551	Thailand	419
Chinese Taipei	531	Uruguay	418
Japan	527	Chile	417
Korea	526	Qatar	414
Estonia	523	Mexico	409
Netherlands	519	Bosnia & Herzegovina	406
Switzerland	515	Costa Rica	402
Poland	516	Jordan	400
Canada	512	Peru	400
Denmark	509	Georgia	398
Slovenia	509	North Macedonia	394
Belgium	508	Lebanon	393
Finland	507	Colombia	391
Sweden	502	Brazil	384
United Kingdom	502	Argentina	379
Norway	501	Indonesia	379
Germany	500	Saudi Arabia	373
Ireland	500	Morocco	368
Austria	499	Kosovo	366
Czech Republic	499	Panama	353
Latvia	496	Philippines	353
France	495	Dominican Republic	325
Iceland	495		
New Zealand	494		
Portugal	492		
Australia	491		
Russia	488		
Italy	487		
Slovak Republic	486		
Luxembourg	483		

Hungary	481		
Lithuania	481		
Spain	481		
United States	478		
Belarus	472		
Malta	472		
Croatia	464		
Israel	463		
Turkey	454		
Ukraine	453		
Greece	451		
Cyprus	451		
Serbia	448		
Malaysia	440		
United Arab Emirates	435		
Albania	437		
Romania	430		
Bulgaria	436		
Brunei Darussalam	430		
Montenegro	430		

***B-S-J-Z (China) refers to Beijing, Shanghai, Jiangsu and Zheijang*

provinces/municipalities.

Appendix E

2018 Performance Snapshot for Science

Countries/Economies	Science (Mean)	Countries/Economies	Science (Mean)
B-S-J-Z (China)**	590	Mexico	419
Singapore	551	Qatar	419
Macao (China)	544	Albania	417
Estonia	530	Costa Rica	416
Japan	529	Montenegro	415
Finland	522	Colombia	413
Korea	519	North Macedonia	413
Canada	518	Argentina	404
Hong Kong (China)	517	Brazil	404
Chinese Taipei	516	Peru	404
Poland	511	Baku (Azerbaijan)	398
New Zealand	508	Bosnia & Herzegovina	398
Slovenia	507	Kazakhstan	397
United Kingdom	505	Indonesia	396
Australia	503	Saudi Arabia	386
Netherlands	503	Lebanon	384
United States	502	Georgia	383
Belgium	499	Morocco	377
Sweden	499	Kosovo	365
Czech Republic	497	Panama	365
Ireland	496	Philippines	357
Switzerland	495	Dominican Republic	336
Denmark	493		
France	493		
Portugal	492		
Austria	490		
Germany	490		
Norway	490		
Latvia	487		
Spain	483		
Lithuania	482		
Hungary	481		
Russia	478		
Luxembourg	477		

Iceland	475		
Croatia	472		
Belarus	471		
Ukraine	469		
Italy	468		
Turkey	468		
Slovak Republic	464		
Israel	462		
Malta	457		
Greece	452		
Chile	444		
Serbia	440		
Cyprus	439		
Malaysia	438		
United Arab Emirates	434		
Brunei Darussalam	431		
Jordan	429		
Moldova	428		
Romania	426		
Thailand	426		
Uruguay	426		
Bulgaria	424		

Appendix F
National Career Clusters

Health Science

Business, Management, and Security Administration

Marketing

Finance

Information Technology Communications

Science, Technology, Engineering

Manufacturing

Transportation, Distribution, and Logistics

Hospitality and Tourism

Government and Public Administration

Law, Public Safety, Corrections

Agriculture, Food, and Natural Resources

Human Services

Architecture and Construction

Education and Training

Arts, Audio/Visual Technology, and Communications

Energy

Appendix G

Information Sheet for Exempt Research

THE IMPACT OF THE DEGREE OF STANDARDIZATION AND STRATIFICATION ON STUDENT ACHIEVEMENT

You are being asked to be in a research study that is being done by Jennifer Hernandez under the direction of Dr. David Strubler, Ph.D., Professor in the Department of Organizational Leadership. Your decision to participate in this study is voluntary. You can choose to stop your participation at any time or skip any part of the study if you are not comfortable. Your decision will not affect your present or future relationship with Oakland University, the researcher, the Department of Organizational Leadership.

The purpose of this research study is to determine if there is a relationship between the degree of standardization-stratification and student achievement. You are being asked to participate in the study because you have knowledge of and work in Career and Technical Education.

You will be asked to complete an online survey at a location of your choosing. At the end of the survey you will be asked to participate in a follow-up interview. If you wish to participate in the interview, you will be asked to provide your email address. You will be contacted via email to schedule the interview. Interviews will be conducted over Zoom and will be audio recorded. Audio recordings will be transcribed. The transcription of your interview will be sent to you via email. You will review the transcription and edit the content for accuracy. You will email it back by replying to the original email.

The estimated length of time to complete the online survey is 30 minutes. The survey will be open for 3 weeks. For those choosing to participate in an interview, the estimated

length of time to complete the interview is 1 hour. Interviews will be conducted over a 3-week period. Participants of the interviews will have 3 weeks to complete a review of their transcription. The total time to complete the entire study is estimated at 9 weeks.

For this study, the potential risks are minimal. No identifiable data that can directly be linked to you are collected. There may be a risk that someone who is not part of this research may accidentally see your personal information. We will try to make sure that this does not happen by keeping your research records as confidential as possible. When the results of this research are published or presented at conferences; no information will be included that personally identifies you. For the interview, all audio recordings will be deleted once the transcriptions are complete. There may be no direct benefits to you, however, the results of this study may benefit others in the future. You will not receive anything for participating in this study. If you want to stop participating in this study, close your browser before completing and submitting the survey. If the survey is submitted, it will not be possible to withdraw your data from the study.

If you have questions about this study, contact Jennifer Hernandez at jahernan@oakland.edu or call (586)480-3389. The faculty advisor, David Strubler can be contacted at strubler@oakland.edu or call (248)370-4628

For questions regarding your rights as a participant in human subject research, you may contact the Oakland University Institutional Review Board at (248) 370-4898.

To consent to this survey, click yes in the box below. Otherwise, click no.

- ☐ Yes
- ☐ No

Appendix H

CTE Survey

- Q1 Name of School District
- Q2 City in which your school district resides
- Q3 How many years have you been working in education?
- Less than 1 year
 - 1 - 5 years
 - 6 - 10 years
 - 11 - 15 years
 - 16 - 20 years
 - 21 - 25 years
 - More than 25 years
- Q4 Select your role in CTE
- Teacher
 - School Administrator
 - District Administrator
- Q5 How many years have you been teaching in CTE?
- Less than 1 year
 - 1 - 5 years
 - 6 - 10 years
 - 11 - 15 years
 - 16 - 20 years

- 21 - 25 years
- More than 25 years

Q6 Select the career cluster that you teach in

- Health Science
- Business, Management and Security Administration
- Marketing
- Finance
- Information Technology Communications
- Science, Technology, Engineering
- Manufacturing
- Transportation, Distribution and Logistics
- Hospitality and Tourism
- Government and Public Administration
- Law, Public Safety, Corrections
- Agriculture, Food and Natural Resources
- Human Services
- Architecture and Construction
- Education and Training
- Arts, Audio/Visual Technology, and Communications
- Energy

Q7 For each statement, indicate your agreement.

	Disagree 0 1 2 3 4 5	Agree 6 7 8 9 10
My CTE program uses the National Career Cluster standards.		
The standards in my CTE program integrates the Michigan High School Content Standards when appropriate.		
I use state/national standards to develop outcomes for student learning.		
My students are knowledgeable about the standards used in my program.		
I use state/national standards to plan for instruction.		
I group my students by ability within my CTE classroom.		
I use assessments to measure the degree to which my students have met the standards.		
My program of study aligns with the technical skills needed to achieve a credential.		
My program of study aligns with the content needed to achieve a credential.		

Q 8 Did your students participate in pre-vocational programs?

- ☐ No
- ☐ Yes

If yes, go to Q9. If no, go to Q 10.

Q9 At what grade level did your students participate in pre-vocational programs?

- ☐ 5th grade
- ☐ 6th grade

- ☐ 7th grade
- ☐ 8th grade

Q10 At what grade level can students enroll in your CTE program?

- ☐ 9th grade
- ☐ 10th grade
- ☐ 11th grade
- ☐ 12th grade

Q11 What selection criteria do you use when placing student in your CTE program?

Select all that apply.

- ☐ Application process
- ☐ Prerequisite coursework
- ☐ Placement tests
- ☐ Prior academic performance
- ☐ Teacher recommendation
- ☐ Parent endorsement
- ☐ Student interest
- ☐ Family member of a current or past CTE student
- ☐ Other (please indicate)

Q12 Please indicate if you are willing to be contacted for a follow-up interview

- ☐ No
- ☐ Yes

If yes, go to Q13. If no, exit survey

Q13 Please provide a valid email address so you can be contacted for a follow-up interview.

Appendix I

Email to CTE Educators

Dear CTE Educator,

My name is Jennifer Hernandez, and I am a doctoral student at Oakland University in the Department of Organizational Leadership. For my dissertation, I am examining the impact of standardization on student achievement in Career and Technical Education programs. I'm inviting you to take the survey using the link below.

The survey will only take about 5 minutes to complete and does not collect any personal identifiable information. Those who choose to participate are encouraged to answer all of the questions honestly.

Survey link: https://oakland.az1.qualtrics.com/jfe/form/SV_6zEMVJVEjj0FrEi

Thank you for taking the time to assist in my dissertation. Please feel free to share the link with your CTE colleagues. If you have any questions, you can contact me directly at jahernan@oakland.edu.

Sincerely,

Jennifer Hernandez

Appendix J

Email to CEPD Directors

Dear CTE Director,

My name is Jennifer Hernandez, and I am a doctoral student at Oakland University in the Department of Organizational Leadership. For my dissertation, I'm examining the impact of standardization and tracking on student achievement in Career and Technical Education programs across the state. I'm inviting you to participate in this research study by completing an online survey. I'm also encouraging you to forward this email to your local CTE administrators, principals, and teachers so that they may participate as well.

The survey takes about 5 - 10 minutes to complete and does not collect any personal identifiable information. If you choose to participate, you should answer all of the questions to the best of your knowledge.

Survey link: https://oakland.az1.qualtrics.com/jfe/form/SV_6zEMVJVEjj0FrEi

I appreciate your willingness to assist me in my dissertation. If you have any questions, you can contact me directly at jahernan@oakland.edu.

Sincerely,

Jennifer Hernandez

Appendix K

Email to Participants for a Follow-Up Interview

Dear CTE Educator,

My name is Jennifer Hernandez and I am a doctoral student at Oakland University in the Department of Organizational Leadership. Last spring you participated in my research study by completing the CTE Survey. On the survey you indicated that you would be willing to participate in an online interview.

Due to the overwhelming response of participants wanting to be included in the interviews, I will be conducting focus groups of 3-6 CTE educators on Zoom. If you choose to participate, I ask that you set aside 60 minutes for the Zoom meeting. The following dates and times are available for the focus group.

April 3rd pm only

April 4th pm only

April 5th am or pm

April 7th pm only

April 8th pm only

April 9th pm only

If you would like to participate in a focus group, please reply to this email with the date and time you are available. Thank you for taking the time to assist in my dissertation. If you have any questions, you can contact me directly at

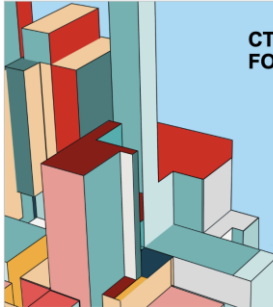
jahernan@oakland.edu.

Sincerely,

Jennifer Hernandez

Appendix L

PowerPoint for Follow-Up Interviews



CTE SURVEY FOLLOW-UP INTERVIEWS

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AGENDA

- Introductions
- Significant Finding From The Research
- Selection Criteria and Process
- Messaging and Marketing to Families
- Finding From the Literature Review
- Final Thoughts

2

SIGNIFICANT FINDING FROM THE RESEARCH

Predict adherence to standards based on access to programs

Adherence to academic standards increased by 2.8 units for every 1 unit increase in access.

The more selection criteria used in the selection process the more teachers adhered to using academic standards in their program.

SHARE YOUR
THOUGHTS

3

SELECTION CRITERIA

- Prior academic performance
- Application process
- Teacher recommendations
- Placement Tests

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THOUGHTS

FINDINGS FROM THE LITERATURE REVIEW

Messaging to Families

"Preparing for the real world"

"Making connections with peers, instructors, and employers with similar interests"

"Opportunities to take classes that focus on gaining skills in a specific field"

Marketing Program

career exploration

gaining skills

getting hands-on experience

finding a career passion

finding the right-fit

CTE prepares learners for college and career success

Advanced CTE 2021

SHARE YOUR
THOUGHTS

7

FINDING FROM THE LITERATURE REVIEW

- Most CTE programs are not aligned with academic standards.
- Teacher believed that CTE learning standards improved rigor, credibility, and parity with academic courses and attracted higher-performing students to their classes. However, they reported that CTE standards were not consistently implemented.
- The route CTE teachers take to obtain certification may be lacking in training on academic standards

Kim et al. (2021)
Castello et al. 2007

SHARE YOUR
THOUGHTS

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SHARE YOUR
FINAL THOUGHTS

THANK YOU

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