Michigan High School Reform's Effect on Community College Students' Preparedness for College-Level Courses

by

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List of Acronyms

Achieving the Dream ..... ATD

Every Student Suceeds Act ..... ESSA

Free / Reduced Lunch ..... FRL

Michigan Merit Curriculum ..... MMC

National Assessment of Educational Progress ..... NAEP

No Child Left Behind ..... NCLB

Socioeconomic Status ..... SES

Abstract

This quantitative study examines college readiness of high school graduates before and after the implementation of a high school curriculum mandated in Michigan in 2005 that includes math, science, language arts, and social science courses and is commonly referred to as the Michigan Merit Curriculum (MMC). This study analyzes records of 5,185 students who graduated from Michigan public high schools from 2008 to 2014 and entered a community college less than one year after high school graduation. A binomial logistic regression controlling for gender, race, and the free/reduced lunch (FRL) rate of the high school the student graduated from is used to determine if the students who experienced the MMC are more likely to place into college-level courses. The results suggest that community college students are 1.5 times more likely to be at college level in math, writing, and reading after controlling for gender, race, and FRL rate of the high school from which the student graduated if they graduated from a Michigan public high school after the MMC was implemented.

Keywords: curriculum reform, secondary education -- United States, high school graduation requirements, high school curriculum, college entrance exam, ATD, mandated curriculum, common course sequence, Michigan Merit Curriculum.

Chapter One: Introduction

Remedial Education, Legislation, and the Michigan Merit Curriculum

Nationwide about 60 percent of community college students are placed into at least one remedial course based on their college placement exam scores (Luczyk, 2012). College remedial education has gained much attention in the media as state legislatures create laws that upend decades-old college policies and politically savvy groups like Complete College America crusade to improve remedial education. Across the nation, some state legislatures have abolished remedial classes at universities or made them optional. Complete College America strives for students to be placed into credit-bearing courses with extra academic support, rather than in the typically noncredit remedial pathway.

The remedial course is designed to assist the student to meet the skill level needed to be successful in a college-level class and lead to successful degree completion. The course topics of a college pre-algebra remedial math course are fractions, percentages, measurement, geometry, signed numbers, linear equations, proportions, and story problem solving techniques. The pre-algebra course topics are usually taught in math courses in grades three through nine. Research shows that only 29% of students enrolled in remedial college courses graduate college within eight years (Strong American Schools, 2008). It is not surprising that only 29% of students enrolled in remedial college courses graduate college within eight years when considering that students taking remedial math are expected to grasp many years' worth of math content in one semester.

State legislatures have attempted to legislate ways to prepare students successfully for college so they can place immediately into college-level courses. In 2011, Ohio phased out remedial education at its public universities (Pant, 2012). The Ohio state legislators have eliminated funding at the university level for remedial education or prohibited four-year public universities from offering funding. Students who score below college level on the ACT or other placement exams must take courses at a community college until they demonstrate proficiency in a given subject matter so they meet the basic requirements for entry into college-level courses at the university. Ohio's action as a state mirrors the actions of City University of New York's actions in 1999 when the system with more than 200,000 students eliminated remedial classes at its colleges (Parker & Richardson, 2005).

As of 2014, Florida's legislature has made placement tests and remedial classes entirely optional for students who recently graduated from a state public high school or who are active-duty members of the military (Mangan, 2013). The Florida legislature believed that "shunting students immediately into catch-up classes—which students must pay for even though they garner no credits—deters too many from completing their studies" (Porter, 2014, p. 1). Prior to legislating change regarding remedial education in higher education, Florida sought improvement in K12 education. Florida instituted changes to better prepare students for high school work by requiring middle school students to complete a minimum number of courses in the core-academic subjects to finish grade eight and be admitted to high school. High school requirements included rigorous math and science classes for all students (Olson, 2006).

The Michigan School Reform Act 451 of 1976 was passed by the Michigan Legislature and became effective in January of 1977. Section 380.1 of the Act states, "This act shall be known and may be cited as 'the revised school code' "(Michigan Legislature, 2016a).

Amendments were made to the Act in 1977, 1988, 1990, 1995, 1996, 2003, and 2004. The Act was once again amended in 2006 as a result of Public Acts 123 and 124. The 2006 amendment to the Revised School Code addressed curriculum requirements for high school graduation (Michigan Legislature, 2016b). The Revised School Code, M.C.L. § 380.1278 is commonly referred to as the Michigan Merit Curriculum (MMC). The MMC requirements for students, beginning with pupils entering grade eight in 2006 include:

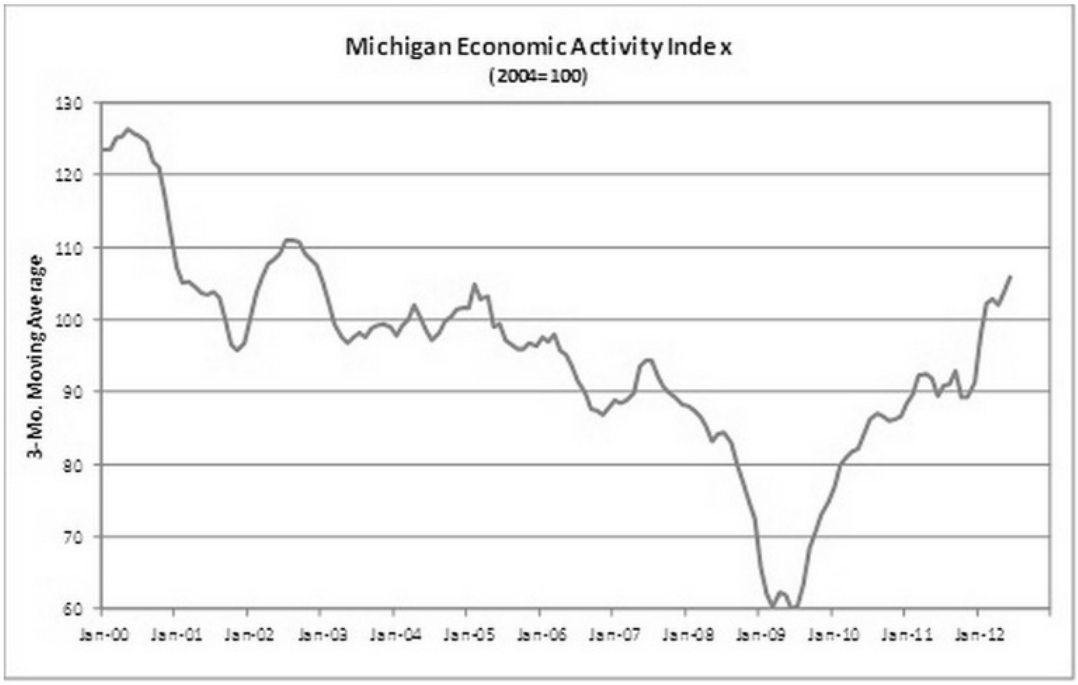
- at least 4 credits in English language arts;
- at least 4 credits in mathematics, including completion of at least 2 algebra courses, 1 geometry course, and an additional course beyond algebra I and geometry;
- at least 3 credits in science including completion of at least 1 biology course, 1 chemistry or physics course, and 1 additional science credit;
- at least 0.5 credits in civics, 0.5 credit in economics, 1 credit in United States history and geography, and 1 credit in world history and geography;
- at least 1 credit in health and physical education from among courses approved by the department; and
- at least 1 credit in fine arts or music from among courses approved by the department (Michigan Legislature, 2016b).

The purpose of the MMC was to ensure that Michigan high school graduates could be successful in the workplace if they entered jobs that did not require a college degree and could be successful in college if they sought a job that did require a college degree (Michigan Department of Education, 2007). At the time the MMC was passed, Michigan's legislators believed more students were going to need a college degree to obtain a living-wage job because of the great

change in economic activity in Michigan. Michigan had been the automotive manufacturing hub of the world since the invention of automobiles. Ford, General Motors, and Chrysler, the three largest automotive companies in the 1900s, centered their headquarters and manufacturing operations in Michigan. It was commonplace for Michigan high school graduates to obtain jobs in manufacturing, service, or retail immediately after graduation (Walker, 2006).

Before the time frame when the MMC was passed into law, Michigan was losing jobs as automotive manufacturers and automotive suppliers moved their operations from Michigan to locations where labor costs were cheaper. When the manufacturing work left Michigan, the companies that formerly did the manufacturing in Michigan no longer needed the employees, nor the goods and services from local companies. Likewise, the former employees at the manufacturing companies and local companies no longer had money to spend at stores, restaurants, or on recreational activities, homes, or home repair. The result was a domino effect that created more loss of jobs (Dizikes, 2012). Figure 1 gives Michigan's Economic Activity Index from 2000-2012. It was the downward trend in Michigan's Economic Activity Index from 2000-2005 shown in Figure 1 that prompted Michigan's legislators to write and pass the MMC in 2005. The MMC addressed the exodus of manufacturing, service, and retail jobs in Michigan. The MMC prepared the students who previously would have entered the job market directly after high school for college level readiness if they could not follow in their parents' and grandparents' footsteps.

Figure 1
Michigan Economic Activity Index



(Comerica, 2013)

In addition to preparing students for college, the intent of the MMC was to attract companies to locate in Michigan. As stated by the Michigan Department of Education (2007, p. 1),

> Michigan is committed to having the best-educated workforce. The Michigan Merit Curriculum defines a common set of required credits for graduation and provides educators with a common understanding of what students should know and be able to do for credit. It also provides students the learning opportunity, knowledge and skills they need to succeed in college or the workplace.

Expectations of the more challenging curriculum requirements were that standardized test scores would improve and all students would be prepared for college (Sebring, 1985a).

Michigan implemented the MMC in 2006. Forty-four states mandated at least twelve courses in the high school curriculum before Michigan. Researchers have found mixed results when researching the higher expectations related to state-mandated high school curriculums. Toch, Jerald, & Dillon (2007) concluded that high school curriculum reform helps improve graduation rates, and a rigorous curriculum produces significant improvements in student learning. In contrast, Carlson & Planty (2012) found increased graduation requirements to be ineffective because teachers and administrators allowed students to pass through the system without actually accomplishing the new comprehensive requirements. Carlson & Planty did not find significant improvements in student learning and reached their conclusions after performing a transcript audit to "examine the prevalence with which students who fail to meet graduation credit requirements in science or mathematics are awarded regular or honors high school diplomas" (Carlson & Planty, 2012, p. 605).

However, a common theme in the research related to increased high school curriculum requirements is that certain sectors of students may benefit from more demanding graduation requirements. Chaney, Burgdorf, & Atash (1997) concluded that students most likely to be affected by a mandated curriculum, including math and science courses, are students with marginal skills that would not have been on a college preparatory path if not for the mandated curriculum. Likewise, Castro (2013) found students of color and students from lower income families benefit from college and career readiness interventions with improved high school completion rates and scores on standardized tests. Castro's findings lead this author to believe that the students entering community college in a neighboring suburb of an urban setting will benefit from the MMC. These students will be more likely to place into college-level classes as a result of the 2006 legislation.

This study will target the populations that Chaney et al. (1997) and Castro (2013) concluded would be most affected by Michigan's MMC. This study's sample is incoming students at a community college in southeast Michigan who graduated from a public high school that implemented the MMC and who entered college less than one year after graduating from high school. This sample is 10-15% students of color. The average free/reduced lunch (FRL) rate of the high schools from which the students in the sample graduated from ranged 40-70% over the years of the students studied.

The intent of the MMC, to prepare all students for college, will be examined by comparing Achieving the Dream (ATD) rankings for two groups of students at a southeast Michigan community college; those students graduating before the implementation of the MMC (pre-MMC) and those students graduating after the implementation of the MMC (post-MMC). ATD rankings designate a student's preparedness for college-level classes.

- ranking of 0 = student at college level
- ranking of 1 = student 1 level below college level
- ranking of 2 = student 2 levels below college level
- ranking of 3 = student 3 levels below college level
- ranking of 4 = student 4 levels below college level

Data show that in 2001 Michigan, Colorado, Massachusetts, Nebraska, Pennsylvania, and Iowa were the only states that did not have at least 12 courses in the high school curriculum required at the state level (National Center of Education Statistics, 2001). In Michigan, graduation requirements were set locally until the Michigan legislature passed the MMC and mandated a new set of statewide graduation requirements in 2006. Starting with the high school

graduating class of 2011, Michigan increased the required high school curriculum to include the following:

- a mathematics course sequence: four credits including algebra I, algebra II, geometry, and one math course in final year of high school;
- a science course sequence: three credits including biology, physics or chemistry, and one additional science credit;
- four credits of English language arts;
- three credits of social studies including: one-half credit in, one-half credit in economics, U.S. history and geography, world history, and geography;
- one credit of physical education and health; one credit of visual, performing, and applied arts; and an online learning experience (Michigan Legislature, 2016b).

Statement of Problem

Remedial classes are defined as courses designed to develop the basic skills necessary to be successful in college-level classes. Remedial course learning outcomes are comparable to content offered at the elementary through high school level and are not counted toward a degree program. College students pay college tuition rates to learn the same content taught in K12 education. Remedial classes are more costly for a post-secondary institution to deliver than college-level classes because of the one-on-one tutoring and small class sizes necessary to help students be successful in remedial classes.

Esch (2009) found that students who place into remedial classes are at a higher risk of never completing a degree. This study will examine college readiness of the incoming students at a community college to determine whether the mandated high school curriculum in Michigan has made it less necessary for them to take remedial classes. If the new curriculum has assisted

students with being less likely to take remedial classes, then according to Esch (2009), students experiencing the new curriculum will be more likely to complete a degree.

Purpose of the Study

This study examines whether students entering a public, two-year community college, with no admission requirements other than a high school diploma or GED, score higher on entrance exams as a result of a more rigorous high school curriculum mandated by the state. This study focuses on Achieving the Dream (ATD) rankings derived from entrance exam test scores for incoming community college students for three subjects: math, reading, and writing. ATD rankings are used because entering students take three different college entrance exams: ACT, ASSET, and Compass. High school students take the ACT test if they plan on attending college. Students entering a skilled trades program take the ASSET test. Students take the Compass test if they have not previously taken the ACT or ASSET test before applying to the college. The scores on the ACT, Compass, or ASSET tests are converted to ATD rankings to serve as a tool to place incoming students into the appropriate college course with the appropriate difficulty level.

ATD rankings designate a student's preparedness for college-level classes. Rankings range from 0 to 4. With a ranking of 0, a student can enroll in college level classes in that subject. With a ranking of 1, a student must successfully take at least one remedial course in that subject before he or she can enroll in a college level class in that subject. With a ranking of 2, a student must successfully take at least two remedial courses in that subject before he or she can enroll in a college level class in that subject. The rankings have been collapsed to two levels for this study: at college level and not at college level. The rankings are compared for those students that have experienced a state-mandated rigorous curriculum (post-MMC group) to those that have not experienced a state-mandated rigorous curriculum (pre-MMC group).

The purpose of this quantitative study is to determine whether the MMC has an effect on community college students placing into college-level math, reading, and writing courses. The Michigan legislature enacted the law to institute the more rigorous curriculum with the intent that students would be better prepared for college with a mandatory state curriculum that includes a rigorous math, science, social studies, and language arts course load (Michigan Department of Education, 2006). This study analyzes college-level readiness in math, reading, and writing for incoming students at a community college in southeast Michigan. The analysis performed is a binomial logistic regression. The independent variables are the high school curriculum, race, gender, and FRL rate of the high school from which the student graduated. The dependent variables are the college-level readiness in math, reading, and writing as designated by an ATD ranking.

Framework of the Study

Since the 1980s, state high school graduation requirements have moved from being set at the local or district level to being state-mandated. The report by the National Commission on Excellence in Education, *A Nation At Risk: The Imperative for Education Reform* report (National Commission on Excellence in Education, 1983) is one of many factors that drove this action. The report, *A Nation at Risk,* surveyed high schools and studied Scholastic Aptitude Test (SAT) scores. The report determined that the schools in the United States were failing. The report provided evidence of the failing schools as follows: student achievement on international academic tests were falling, illiteracy was rising, SAT scores and college board achievement scores were declining, and military leaders complained of needing to provide remedial training programs. The report made a recommendation that high school curriculums should include four years of English, three years of mathematics, three years of science, three years of social studies,

and one-half year of computer science. The report stated these changes would improve standardized test scores and make United States students better prepared to compete in the global economy. *A Nation at Risk* suggested a mandated curriculum with one set of academic goals for everyone. Lee, Croninger, & Smith (1997) state that a narrow set of mandated academic courses will have positive academic benefits for students. Michigan's MMC includes a math course sequence, a science course sequence, four credits of English language arts, three credits of social studies, one credit of physical education and health; one credit of visual, performing, and applied arts, and an online learning experience.

This quantitative study compares college placement levels for two groups of Michigan high school graduates entering a community college: pre-MMC students who graduated before the state-mandated high school curriculum change (2008-2011) and post-MMC students who graduated after the state-mandated high school curriculum change (2011-2014). This study will test the state mandated curriculum by analyzing the college preparedness (ATD rankings) of students whose high school education centered around a narrow set of academic courses (the MMC) and compare them to the college preparedness (ATD rankings) of students who did not complete a mandated set of academic courses in high school (pre-MMC).

Research Question

This study investigates the effects of the MMC on ATD rankings for students who register for the first time at a southeast Michigan community college. The students are divided into two groups. The pre-MMC Group graduated from high school the three years prior to when the MMC took effect in 2011. The post-MMC Group graduated the four years after the MMC took effect or 2011-2014. This study asks the question, are community college students better prepared for math, reading and writing college-level courses if they have experienced a high

school curriculum mandated at the state level that includes a four-credit math course sequence, a three-credit science course sequence, four credits of English language arts, and three credits of social studies?

Research Hypotheses

The null hypothesis is that there will be no difference in the levels of student preparedness for math, reading, and writing college-level courses between those that completed high school with the MMC and those that completed high school before the MMC.

The directional hypothesis is that the state-mandated high school curriculum will make students better prepared for college math, writing, and reading courses as evidenced by ATD rankings. This is grounded in the constrained curriculum theory that a single set of academic goals is appropriate for all participants.

The independent variables are the high school curriculum of the entering students, gender, race, and FRL rate of high school the student graduated from. The students either completed high school during the MMC or they did not. The dependent variable is the students' college-level preparedness. Their college-level preparedness is measured by their ATD ranking placing them at college level or below college level for math, reading, and writing.

Delimitations

Student ATD rankings will be examined for students entering a southeast Michigan community college from 2008-2014. The students in the study will be from public high schools in Michigan. Entrance exam scores are converted to ATD rankings so all students are on the same scale. The ATD rankings are collapsed into two levels. ATD rankings are assigned for the three subject areas measured by the entrance exams: reading, writing, and math. Science and

social science subjects are not on the entrance exams and do not have ATD rankings in the student records.

Significance of the Study

The significance of this study stems from the current national dialogue on what students' high school curriculum should include and how it effects remedial education in higher education. Has Michigan's approach worked? This study is significant because it extends the 2012 work of Dynarski, Frank, Jacob, & Schneider and Cousineau. In 2012, those two studies only had data on one graduating class that had completed the MMC. This study has data on four graduating classes that have completed the MMC.

This study is significant because political leaders, university administrators, and K12 school administrators are locked in debates about financing in K12 education, financing college, and best practices in preparing students for college. This study can inform if money spent on teaching a rigorous college preparatory curriculum to all high school students is money well spent and reduces the need of federal financial aid money for remedial education in college.

This study is significant because the MMC imposed many challenges on high school educators such as changes to lessons, reconfiguring of classes, participation in professional development, and new textbook adoptions. (The Center for Local, State, and Urban Policy, 2010). Teachers should find out if their efforts have produced students better prepared for college. Parents should learn if their child's curriculum is producing positive results. High school and school district administrators should be informed about the MMC's effect on high school graduates.

Chapter Two: Literature Review

Before the study on students who experienced a state-mandated curriculum commenced, a review of the literature pertaining to this study was conducted. This study is analyzing whether remedial class placement at a community has declined since a rigorous high school curriculum was mandated at the state level in Michigan. The literature was reviewed for research related to remedial class placement, legislation related to remedial education, the evolution of the Michigan Merit Curriculum (MMC), research on mandated rigorous high school curriculums, and research on the MMC. This study seeks to add to the existing database of research on how best to educate our children.

Remedial Class Placement

Remedial class placement is a topic of interest for politicians, educators, school administrators and researchers. One area of agreement among education researchers is that remedial class placement in college is problematic, as evidenced by the percentage of students who do not place into college level classes. The National Center for Education Statistics (2013) reported the percentage of first-year students taking remedial courses at two-year public institutions of higher education for academic years 1999–2000, 2003–04, and 2007–08 were 30%, 23%, and 24%, respectively. Other research findings, however, report the placement of students in remedial courses to be higher:

- "Developmental or remedial education is widespread: Our analyses indicate that about 40% of traditional undergraduates take at least one such course." (Attewell et al., 2006, p. 886).
- Cavanagh (2003) reported "Thirty-five percent of students entering two- and four-year public and private colleges took at least a year of remedial courses during 2000… Five years ago, 28 percent spent that much time in remedial classes" (p. 5).
- "Twenty-nine percent of first-time freshmen enrolled in at least one remedial reading, writing, or mathematics course in fall 1995" (Lewis, 1996, p. 9).
- "Every year in the United States, nearly 60% of first-year college students discover that, despite being fully eligible to attend college, they are not ready for postsecondary studies." (National Center for Public Policy and Higher Education, 2010)

The percentage needing remedial education is not consistent from researcher to researcher; however, researchers place the nationwide number between 23% and 60%.

Politics of Remedial Education

Remedial education is expensive (National Center for Policy Analysis, 2001). Students pay tuition for courses that do not earn college credit. Federal financial aid dollars are spent on course topics that should have been learned at the K12 level (National Conference of State Legislatures, 2015). Saxon and Boylan (2001) used two approaches to quantify the cost of remedial education at U.S. colleges and universities. Their estimates place the cost nationally between $911 million and $1.05 billion annually. This cost reflects only expenditures reported to deliver remedial courses. It does not reflect the cost of learning laboratories, tutoring, or learning

assistance. Public colleges and universities pay a premium to deliver the necessary one-on-one tutoring and small class sizes necessary to make remedial classes more successful (Bettinger & Long, 2009). Students needing remediation must spend more time obtaining their degree, delaying their entrance into the professional workforce earning associated wages.

Florida legislators made remedial courses optional in 2013 for recent high school graduates (Mangan, 2013) and passed legislation that dictates older students will complete their remedial courses as a co-requisite online while simultaneously taking college-level courses (Mangan, 2013). In 2012, Connecticut and Colorado laws limited remedial course work to one semester (Ashford, 2014). Louisiana, Tennessee, South Carolina, and Ohio no longer allow remedial education at four-year public universities (Carr, 2015). In 1999, the City University of New York eliminated most remedial courses at its four-year institutions (Fullinwider, 1999).

Remedial education is meant to serve the student who does not score well enough on a test to enroll in college-level courses. In 2006, Michigan's legislature passed the Michigan Merit Curriculum (MMC). The MMC described the exact classes that all students must take to earn a high school diploma. Michigan legislators have taken the position that the MMC will reduce the need for remedial education in Michigan. The premise by the authors of the MMC is that if students take more math, science, social science, and language arts courses in high school, they will be prepared to enter college-level courses upon graduation from high school. This will eliminate the need for costly remediation courses at the college level.

Evolution of Michigan Merit Curriculum

The courses included in the MMC are a return to the curriculum established for high school when public high schools were first established in Michigan in the late 1800s. The Committee of Ten in 1892 established the high school curriculum for all high schools in the

United States. The high school curriculum changed in the early 1900s when the option of vocational education was introduced to the high school curriculum. The high school curriculum slowly returned to college preparatory course sequences of math, science, language arts, and social science classes with the events of the twentieth century and economic activity changes in Michigan in the twenty-first century.

College preparatory course sequences in high school. In 1874, a Kalamazoo, Michigan court case upheld that public schools must be provided for 14-17 year olds *(Stuart et al. v. Kalamazoo)*. Almost two decades later in 1891, the National Council of Education received a report on the uniformity of high school programs in the United States, and the National Council of Education authorized a committee to hold a conference to continue the discussion on the uniformity of school programs. The conference was held July 7-9, 1892, and had 20-30 delegates (National Education Association, 1894).

The July 1892 conference recommended that an additional conference be held for each principal subject taught in secondary schools and required for college admissions. Each conference would determine the proper limits of the subject, the teaching time allotment, and the best teaching and testing methods for the subject (National Education Association, 1894). The July 1892 conference also appointed a committee of ten people to arrange the conferences and select the attendees of the conferences. The committee of ten people was comprised of prominent university administrators and professors, the United States Commissioner of Education, and administrators from high schools. The National Council of Education adopted the recommendations of the July 1892 conference and communicated them to the National Education Association. The National Education Association directors made $2500 available for the undertaking of the conferences.

The committee that became known as the Committee of Ten, organized nine conferences in November of 1892 on the following nine subjects: Latin, Greek, English, other modern languages, math, science, natural history, history, and geography. Ten experts for each conference were selected by the Committee of Ten and charged with determining the appropriate high school curriculum for each topic (National Education Association, 1894).

The nine conferences took place for three days in December 1892. The report of the December 1892 conferences acknowledged that many high school students would not complete four years of high school so they placed courses necessary for a person to prepare for the duties of life within the first two years of the high school curriculum. The committee also recognized that an insignificant percentage of students would continue on to college, but the role of high schools was to make all high school graduates ready for college. The Committee of Ten decided all students would study the same subjects regardless of their economic, social, and ethnic backgrounds and their plans after high school. The high school curriculum of college preparatory course sequences established by the Committee of Ten would ensure all groups of students would receive instruction that would allow them to do well in life, contribute to society, and continue on to college (National Education Association, 1894).

Departure from college preparatory course sequences in high school. The United States public high school curriculum philosophy changed throughout the 1900s. The early 1900s saw vast improvements to the country's industrial productivity thanks to the principle of scientific management (Whitaker, 2002). Frederick Winslow Taylor, ~~a~~ pioneer of industrial engineering, developed the principle of scientific management, in which each production worker was given a narrowly defined assignment that he or she was to perform at a specific rate using certain predefined procedures (Taylor, 2012). World War I and the shortages of skilled workers

for industrial productivity, agriculture, and the military was an impetus for establishing vocational education in high school (Wall, 1985). The Vocational Education Act of 1917 (P.L. 64-347; 39 Stat. 929) was commonly referred to as the Smith-Hughes Act of 1917 (U.S. Government, 1917). The Vocational Education Act of 1917 established federal funding to prepare high school students for jobs in the economy that did not require a four-year college degree. Vocational education was a departure from the curriculum established by the Committee of Ten. The vocational education curriculum provided students with practical skills needed for the farms, military, and factories (Lynch, 2000).

National Defense Education Act of 1958. After World War II, the United States and the Soviet Union had a hostile, adversarial relationship. Both countries had hydrogen bomb technology and believed that at any moment the other might attack. This period in history was known as the Cold War between the Soviet Union and western allied countries. In 1957, the Soviet Union launched the first man-made satellite to orbit the earth. This scientific first made the United States' leaders and citizens fear the Soviet Union was technically superior in the area of sciences, space research, and potentially warfare. The United States Congress reacted with plans to invest taxpayer money in strategic areas: the Advanced Research Project Agency (ARPA), the National Aeronautics and Space Administration (NASA), and the National Defense Education Act (NDEA) of 1958 (Flemming, 1960). The NDEA was responsible for finding and nurturing bright minds and giving incentives to pursue higher education. Section 101 of Title I of the Act states:

> The Congress hereby finds and declares that the security of the Nation requires the fullest development of the mental resources and technical skills of its young men and women. The present emergency demands that additional and more adequate educational

> opportunities be made available. The defense of this Nation depends upon the mastery of modern techniques developed from complex scientific principles. It depends as well upon the discovery and development of new principles, new techniques, and new knowledge. We must increase our efforts to identify and educate more of the talent of our Nation (U.S. Government, 1958, p. 1581).

The purpose of the NDEA's ten titles was to discover talented students who could pursue careers in science and technology and strengthen America's leadership in modern and defensive technology. The actions of Congress opened the doorway for bright minds from all classes of society to help lead the country to pioneering scientific excellence (Flemming, 1960).

One of the titles of the NDEA was Title II: Loans to Students in Institutions of Higher Learning. Before 1958, private loans were the only option for civilian students who did not have the cash to pay for higher education. Therefore, post-secondary education was unattainable for the masses. Since Title I of the Act stated, "no student of ability will be denied an opportunity for higher education because of financial need" (U.S. Government, 1958, p. 1581), Title II sought to address the need for financial aid opportunities.

Title II of the NDEA created the first federal student loan program: Loans to Students in Institutions of Higher Education (U.S. Government, 1958). The National Defense Student Loan (NDSL) program provided promising students with an alternative to joining the family farm or a skilled-trade vocation. Low-interest federal loans enabled these students to pursue higher education. The program targeted students with high aptitudes in math, engineering, and foreign languages. Those wishing to pursue a career in teaching were also included in this program. In 1963, 46% of the NDSL recipients were education majors and 21% were identified as having shown superior aptitude in science, engineering, mathematics, and/or foreign languages (Flattau

et al., 2006). The NDEA is responsible for the major shift of college funding from families and university scholarships to federal loans. Title II made higher education attainable for students who needed to finance their education. Title II paved the way for subsequent federal student loan programs (Ihrke, 1962).

A 1961 survey by the U.S. Department of Health, Education, and Welfare revealed that nine out of ten borrowers of the NDSL program depended on these loans to begin and/or continue college (Flattau et. al., 2006). The NDEA made it possible for high school students to dream of careers beyond the industrial production floor. The NDSL provided a pathway to college for the student who did not have the money to pay for it upfront.

A Nation at Risk 1983. In 1981, the U.S. Secretary of Education created a non-partisan commission, the National Commission on Excellence in Education, and charged them with creating a report on the quality of education in the United States. The commission's purpose was to "help define the problems afflicting American education and to provide solutions, not search for scapegoats." (Gardner, 1983, p. 1) The commission's report, *A Nation at Risk*, was completed in April of 1983.The report announced that United States high school students were rapidly falling behind other countries in student achievement on international academic tests, literacy, SAT scores, and college board achievement scores. The report recommended placing emphasis on science, math, and education in general (National Commission on Excellence in Education, 1983).

In response to *A Nation at Risk*, the two most common reforms implemented to raise student achievement and make students better prepared for college were high school curriculum reform and high school graduation exit exams (Callan et al., 2006). Many state legislatures mobilized to improve the preparedness of high school students for college and the career world

by changing curriculums or adding exit exams. Some states took the position that all students should be taking what was considered a college preparatory curriculum. Appendix A shows the state-mandated classes for each state as of 2001. The last column of the table in Appendix A shows the year that each state mandated a rigorous curriculum. The table shows that Alaska was the first state to begin mandating a high school curriculum at the state level in 1978. In the late 1980s after the *A Nation at Risk* report was published, five states followed Alaska's lead. Nine more states mandated a high school curriculum in the 1990s. Twenty-eight states followed suit starting with their graduating classes in 2000-2008.

Michigan Merit Curriculum. In 2001, Michigan, Colorado, Massachusetts, Nebraska, Pennsylvania, and Iowa were the only states that did not have at least 12 courses in the high school curriculum required at the state level (National Center of Education Statistics, 2001). Michigan high school graduation requirements were set locally. In the early 2000's timeframe, Michigan began to discuss joining the other 45 states that had at least 12 mandatory classes in the high school curriculum. In 2006 the Michigan Merit Curriculum implemented a high school curriculum that mandated a math course sequence; a science course sequence; four credits of English language arts; three credits of social studies; one credit of physical education and health; one credit of visual, performing, and applied arts; and an online learning experience.

The Michigan Merit Curriculum established a relationship among high school curriculum, college curriculum, and workforce expectations (Michigan Department of Education, 2007). This study is focused on incoming college students' placement into math, reading, and writing. Those subjects are part of a college's general education requirements. General education requirements are what all graduates of the college must know to graduate without regard to their individual degree programs. General education requirements at the community college are

derived by interviewing and surveying advisory boards, industry employers, and university faculty.

Career and Technical Education Students. Motivating the creators of the MMC was the exodus of industrial jobs in Michigan. During her State of the State address in 2004, Michigan Governor Granholm said at that time,

> We must pave a third road to a powerhouse economy because businesses need more than access to capital. They need a flow of human capital -a skilled workforce to give Michigan's businesses an edge when competition is fierce and margins are tight. In the last century, businesses came to Michigan looking for strong backs. Today, they also need strong minds ready for continuous learning, skilled hands, and an ethic of excellence. (Granholm, 2004, p. 1)

However, the Michigan Merit Curriculum was criticized in its formative stage as detracting from preparing graduates for industrial jobs (Green, 2012). Vocational education in the decade the MMC was implemented is called Career and Technical Education (CTE). If students enrolled in a CTE curriculum must take all the required classes of the MMC, how will they also fit in their vocational classes? The MMC instilled a fear in Michigan CTE educators that CTE enrollment would be reduced as a result of the MMC (Matthews-Cook, 2009). Craft (2008) expressed the same criticism of the MMC in stating that the new requirements of the MMC are difficult for students who choose the CTE path.

Prior to the Michigan Merit Curriculum enactment in 2006, Michigan left graduation requirements up to local school districts. The only statewide requirement was one semester of civics (Walker, 2006). A survey of Michigan school districts found that less than one-third of the state's 770 districts required algebra I to earn a high school diploma; a little more than one-third

required students to pass a biology course (Shakrani, 2006). The previous requirements easily allowed local districts to create CTE programs that did not require intense math, science, and language arts classes. Creators of the MMC believed the high school curriculum, which previously could provide a roadmap to immediate employment after graduation through CTE, must be supplemented by the requirements of the MMC because Michigan's CTE job prospects were largely reduced (Matthews-Cook, 2009). The MMC creators believed the jobs awaiting high school graduates required a college degree. The MMC was intended to give students the skills Michigan legislators believed would be necessary to attain a job after graduation.

Constrained Curriculums

Lee et al. (1997) define a narrow set of mandated academic courses as a constrained curriculum. Michigan mandated a narrow set of academic courses for the high school curriculum starting with the high school graduating class of 2011. In the decade before Michigan's high school curriculum change, 26 states toughened their high school graduation requirements by mandating a narrow set of academic courses. In November 1987, Secretary of Education William J. Bennett, was speaking at an education forum in the city of Chicago and announced that the city of Chicago had the worst school district in the nation (New York Times, 1987). In response to this declaration, in 1997 Chicago Public Schools reformed their high school curriculum based on the philosophy of "College Prep for All" (Mulroy, 2011). Because Chicago Public Schools was one of the first large districts that mandated a college prep curriculum for all students, many researchers have studied its effects.

Chaney et al. (1997) researched Chicago Public Schools after the college preparatory curriculum was mandated, requiring algebra and English I for ninth graders in Chicago. Their research compared students' course-taking sequences with their standardized test scores and with

schools' high school graduation requirements. They found few students were affected by raised graduation requirements because most took more than was required or took courses that did not affect their achievement on tests. Students with marginal motivation and skills did benefit from more demanding courses in the raised graduation requirements, which were reflected in higher scores on standardized tests by this student group.

Allensworth and Nomi (2009) also studied Chicago Public Schools after remedial coursework was eliminated and college preparatory coursework was mandated for all students in 1997. They looked at the effects of requiring students to begin high school taking algebra, rather than remedial math. They studied 9th graders enrolled in Chicago public high schools between 1994 and 2004. They found more students received credit in college preparatory courses, and "The policy most strongly influenced low-ability students, but had almost no effect on the coursework of high ability students" (Allensworth & Nomi, 2009, p. 4). Therefore, Allensworth and Nomi's research validates the findings from Benson (2010) and Chaney et al. (1997).

Benson (2010) had a similar finding to Chaney et al.(1997). Benson concluded that community college students would benefit most from raised graduation requirements:

> Given that community college students tend to be less prepared for college than four-year students, and college readiness significantly influences attainment in almost all postsecondary attainment models, policies that encourage college preparation are directly pertinent to attainment for community college students. (p. 4)

In a more recent study of Chicago Public Schools (Nomi, 2012), math scores declined for high-skill students when remedial math courses were eliminated in Chicago Public Schools in 1997. Schools created more mixed-ability math classrooms because remedial classes were removed from the schedule. The unintended consequence was a decline in scores for high-skills

students on standardized tests. Domina et al. (2014) also looked at the unintended consequences of sharply increasing enrollment of 8th grade students in algebra in a California school district. They evaluated four cohorts of students when the school started its 8th grade algebra initiative. Their study found increasing enrollment in 8th grade algebra did increase but not proportionately to the number of students who successfully completed algebra 2 by the end of 10th grade. However, there was also a sharp decline in student achievement for the students that remained in general math classes. They suggest the stigma of being in a low-level math intensified when the enrollment numbers in general math declined.

Sebring (1985b) studied reformed high school curriculum by using data from six states and examining the level of coursework taken and its effects on performance on standardized exams. Sebring found increased course taking led to higher performance on standardized exams and that each year of American history, foreign language, math, and physical science was positively related to performance on tests.

McPartland and Schneider (1996) examined the impact of a demanding core curriculum for all by looking at graduation failure rates that may accompany new higher curricular standards and reforms that can combat them. They found that to prevent short-circuiting of the core common curriculum to avoid embarrassing failure rates, reforms must be made. Reform examples include enhanced resources and flexible scheduling, revised criteria for academic success, and reconstructed roles and relationships for teachers with regard to learning outcomes.

Daun-Barnett & St. John (2012) examined policy efforts to constrain the high school curriculum and mandate exit exams. Using data for all 50 states from 1990 to 2008, their findings show both constrained math curriculums and mandated exit exams produce an increase in the number of students who continue on to college; however, exit exams decrease high school

completion rates. Their research supports adding a constrained math curriculum in high school. They also emphasize that school funding (expenditures per student) has a positive association with both test scores and graduation rates.

Bishop and Mane (2005) studied the effects of a constrained curriculum on vocational education students. They measured the impact of mandated high school curriculum with math and science requirements on college attendance and completion. They found that vocational education students in states with policies that have a heavy emphasis on the math, science and language arts are more successful in the labor market but less successful in obtaining a college degree.

Schiller and Muller (2003) looked at the association between students' mathematics course work and states' high school graduation requirements and assessment or accountability policies. They found that students in states with more graduation requirements tended to enroll in more advanced math courses as freshmen and persist to take more advanced level courses. However, they found extensive testing had little effect on course taking except to increase differences based on socioeconomic status (SES).

Lee et al. (1997) looked at data from the National Assessment of Educational Progress test for 123 schools. They found students in schools with a constrained curriculum of mostly academic courses learned more based on their scores on the standardized tests. In states without a mandated constrained curriculum of academic courses, Attewell & Domina (2008) found that students from higher SES families take more demanding high school curriculums, and therefore perform better on standardized tests. They found:

> Otherwise equivalent students who took a higher intensity curriculum were significantly more likely to enter college than were those who took the lower intensity curriculum.

> Curriculum had larger effects on college going among the lower (SES) quintiles. In policy terms, this implies that curricular upgrading would be efficacious not only at the most intellectually advanced end of the curriculum (e.g., calculus) but also at the academically less demanding end of the spectrum (Attewell & Domina, 2008, p. 64).

Scott-Clayton (2011) researched constrained curriculums in community college and concludes that a restrained curriculum in community college translates into more graduates. The constraint in her context is a program of classes without room for confusion or complexity on what class to enroll in. She recommends streamlining program plans with minimal choices that provide maximum guidance throughout the registration process every semester. Students can enroll in electives of their choice if they want to customize their program of study but students are sent down a path of classes that will lead to graduation. The path has no complications or roadblocks.

History of Achieving the Dream Initiative

The Lumina Foundation, the nation's largest independent, private foundation committed to increasing the proportion of Americans with high-quality degrees, focuses solely on increasing Americans' success in higher education (Lumina Foundation, 2015). In 2009, they set a goal that 60% of Americans would obtain a high-quality postsecondary degree by 2025. In 2004, The Lumina Foundation launched the major initiative, "Achieving the Dream: Community Colleges Count" (Achieving the Dream, 2014). Its mission was to increase student success at community colleges with high enrollments of low-income students and students of color. Achieving the Dream is a national reform network dedicated to community college student success and completion. Achieving the Dream (2014) states: "Nearly one-half of all students seeking higher education choose a community college. Fewer than half of those students actually finish what

they start." The first stage of the initiative engaged 27 colleges in five states (New Mexico, Texas, Florida, North Carolina, and Virginia). Participating in the initiative meant making large-scale institutional changes, such as committing to student success with long-term policy changes to improve student success, impacting public policy to make community colleges a priority for legislators to finance, and placing more emphasis on gathering and using data to improve student success (Dougherty et al., 2006).

The community college used for my study participated in the Achieving the Dream initiative in the second phase of the initiative when six Michigan Community Colleges were chosen to receive the Achieving the Dream grant. The college incorporated the Achieving the Dream culture of evidence model and included the entire college community in the process of institutional transformation. The college was awarded a $50,000 grant from the Kresge Foundation and joined 82 institutions in 15 states participating in the initiative.

Zachry & Coghlan, (2010) found colleges participating in the Achieving the Dream initiative spent on average $6.3 million on their broad institutional reform process in the three areas of leadership and management, institutional research, and intervention strategies. The money spent on leadership and management focused on colleges' committee work and professional development. Money spent on institutional research included upgrading institutional research capacity, data analysis, and staffing. Money spent on intervention strategies included faculty and staff involvement. Spending differed by institution. "Colleges invested heavily in all three areas, spending an average of 47 percent on implementing their intervention strategies, 33 percent on leadership and management activities, and 20 percent upgrading their institutional research capacity." (Zachry & Coghlan, 2010, p. 3)

Before the Implementation of the Michigan Merit Curriculum

Research was conducted on the difficulty involved in implementing the MMC and the new curriculum's possible negative affects. Three of those studies with concerns of student achievement are discussed in this section. Craft (2008), Richards (2009), and Smith (2011) conducted their studies in the years after the 2005 vote to implement the MMC and before the first graduating class of 2011.

Craft (2008) examined Michigan school superintendents' perceptions of the Michigan Merit Curriculum. His findings stated many superintendents felt the Michigan Merit Curriculum would have negative effects in terms of school finance and student outcomes. His results indicated the state board of education should study student outcomes and determine if the Michigan Merit Curriculum is meeting its goal of preparing students to attend college after high school.

Richards (2009) studied attitudes of parents from rural school districts toward the MMC. He found the majority of parents from this particular population did not support a constrained curriculum because it was too rigid and restrictive. Parents preferred a core curriculum with a common set of academic classes that required all students to focus on reading, writing, and mathematics. Parents also wanted the curriculum to provide some flexibility for students to choose electives based on personal and career aspirations.

Smith (2011) studied the concerns of Genesee County's high school leaders. He found the MMC was a top concern identified by nearly all participants. They were concerned "the actions were not focused on increasing the quality of classroom instruction that high school students receive" (Smith, 2011, p. 146). Craft (2008), Richards (2009), and Smith (2001) agreed that a study of student outcomes after the MMC implementation was needed to determine if the

Michigan Merit Curriculum is meeting its goal of preparing students to attend college after high school.

After Implementation of the Michigan Merit Curriculum

As of 2016, very little research has been done on Michigan's high school curriculum reform. The Michigan Consortium for Educational Research did an analysis on the first graduating class, the class of 2011. The consortium was a partnership between the University of Michigan, Michigan State University, and the State of Michigan. The Michigan Consortium for Educational Research found all students experienced declines in writing scores (Dynarski et al., 2012).

Cousineau (2012) researched the MMC's effect on enrollment in remedial math at community colleges by looking at students under the age of 20 enrolling in remedial math at 28 community colleges in Michigan prior to the MMC implementation. He found an upward trend throughout Michigan of recent high school graduates taking developmental mathematics from 1995 to 2011. In 2011, the number plateaued. "The first graduating class meeting the MMC appears not to have increased the need for developmental mathematics at community colleges" (Cousineau, 2012, p. 36). His data ended with the graduating class of 2011.

French (2015) conducted an analysis of ACT scores before and after the implementation of the MMC at a small parochial school in southeast Michigan. She had records for 23-46 students for each of the three years before the MMC implementation and 26-44 students for each of the three years after the MMC implementation. She compared the mean score on the ACT for each of the two groups and did not find a significant difference between the two groups. She was limited by the very small sample size and recommended the study be repeated on a larger sample size. French's research sample differs from the sample in this binomial logistic regression study

because her sample is from a small parochial school. The sample in this study comes from students who have graduated from public schools.

Gender, Race, and Socioeconomic Status in Education

You (2010) summarized research on gender difference in math learning by categorizing research that has been done on innate ability, attitude, motivation, interest, and performance behaviors. Her summary found conflicting conclusions. Some researchers found male-female differences in math achievement were due to brain differences and learning styles. Other researchers found gender did not play a role in math achievement, but rather how a student is socialized made the difference in a student's math capabilities. Additionally, Chapman (2015) explains the existence of the gender bias in a classroom setting. As recently as 2015 she recommended state departments of education should provide mandatory gender-equity resource modules to in-service teachers and address gender bias needs to all pre-service teachers. Chapman recommends educators need to be made aware of the bias they are reinforcing in their students through socialization messages, inequitable division of special education services, sexist texts and materials, and unbalanced time and types of attention spent on boys and girls in the classroom. The conclusion is that genders learn differently and are treated differently.

Scholars have examined the relationship between ethnicity and academic achievement for decades. Zajda & Freeman (2014, p. 15) summarized findings from the National Educational Longitudinal Study of 1988 as follows: "there are substantial, though not always statistically significant, academic performance differences among ethnic subgroups." Bohrnstedt et al. (2015) performed a study on school composition of race groups and how it affects the achievement gap between the highest and lowest performing groups in school. They found when accounting for SES, student, teacher, and school characteristics, the achievement gap was greater among

schools with the highest Black/African American student density than the schools with the lowest.

Kahlenberg (2013) examined the effect of socioeconomic status by studying a Maryland school district that promoted socioeconomic integration of schools. Kahlenberg found low-income students who attend more-affluent SES schools outperformed low-income students who attend high-poverty schools where $2000 more per pupil was spent. High-poverty schools were defined as those in which at least 50 percent of students are eligible for free or reduced-price lunch.

Literature Review Summary

The history of the high school curriculum dates back to the late 1800s. A college preparatory high school curriculum was established by the Committee of Ten conferences held in 1892. Later, events in the early 1900s established high school curriculums that veered away from college preparatory and created curriculum that provided students with practical skills needed for military, agriculture, and factories.

An emphasis on math and science curriculums in U.S. high schools was revisited with the National Defense Education Act of 1958 and the publication of *A Nation at Risk* in 1984. Researchers who have studied mandated curriculums of math, science, language arts, and social science have concluded that community college students and low-ability students may benefit most from a mandated high school curriculum.

In Michigan, the exodus of manufacturing, retail, and service jobs in the early twenty-first century propelled legislation to implement the MMC. The MMC is a return to the college preparatory course sequence that includes rigorous courses for all ability levels and income levels. Michigan legislators saw a declining shift in vocational career opportunities and instituted

a curriculum that mandates all students to take a college preparatory course sequence that includes math, science, language arts, and social science. The current research on the MMC by Dynarski et al. (2012) and French (2015) have not shown positive results on student exam scores since the curriculum has been implemented. Cousineau (2012) did show a plateaued need for remediation after one graduating class was studied. This study will have a much larger sample size than French or Cousineau because three years of high school graduates will be used from 15 public high schools.

Gender, race, and socioeconomic status have been proven to have an effect on student learning. The research by Bohrnstedt et al. (2015), Chapman (2015), Kahlenberg (2013), You (2010), and Zajda & Freeman (2014) makes a solid case to control for those variables in the regression of this study.

Chapter Three: Research Methodology

The purpose of this quantitative study is to investigate the effects of the Michigan Merit Curriculum (MMC) on the preparedness for college-level classes for incoming students at a southeast Michigan community college. The records analyzed in this study pertain to 5,158 students who graduated from Michigan public high schools in the greater metropolitan area of the community college and entered the community college less than one year after graduating from high school between the years of 2008-2014. A binomial logistic regression is performed with the independent variables of high school curriculum, race, gender, and FRL rate of the high school the student graduated from. The dependent variable is the students' college-level readiness, which has two levels: at college level and not at college level.

The research question is: Are community college students better prepared for math, reading and writing college-level courses if they have experienced a high school curriculum mandated at the state level that includes a four-credit math course sequence, a three-credit science course sequence, four credits of English language arts, and three credits of social studies?

The null hypothesis posited that there would be no difference in the levels of student preparedness for math, reading, and writing college-level courses between those students that completed high school before the implementation of the MMC curriculum and those students that completed high school after the implementation of the MMC curriculum. The directional hypothesis is that the state-mandated high school curriculum will make students better prepared for college math, writing, and reading courses as evidenced by ATD rankings. The directional

hypothesis is grounded in the constrained curriculum theory, which states a narrow set of academic courses will have positive benefits for students.

Participants

The site of this study is a community college in southeast Michigan whose student body includes students from both suburban and urban communities. The local school district with the second largest representation among the student population at this community college is the largest urban school district in Michigan. The average annual enrollment at the community college during the study was 18,000.

The participants in the study are incoming students at the community college that entered the college from fall of 2008 to fall of 2014. This study looks at "first time in college students" that did not take time off between high school and college and graduated from Michigan public high schools that enacted the MMC. The study starts with the records of the 24,102 incoming students at the college from 2008-2014. The records are refined using the criteria described below.

- 192 records are removed from the study because they were early college students. This means they were attending college while in high school.
- 2,505 records are removed because the students had GEDs; therefore, they did not graduate from a Michigan public high school that enacted the MMC.
- 268 records are removed because they did not identify the high school from which they graduated.
- 7,938 records are removed because they took time off between high school and entering college.
- 1,240 records are removed if their race could not be determined from their race selection

- 3,176 records are removed for one or more of the following reasons:
  - Students from schools not bound by the MMC
  - Students from schools that did not have students entering before and after MMC was implemented
  - Students from schools closed before 2012
  - Students from schools opened after 2008
  - Students from schools with "College Preparatory" in its name because those students were already taking a more rigorous curriculum prior to the implementation of the MMC
  - Students from schools that had fewer than 50 students attend the school before and after the MMC implementation

Students from schools that had fewer than 50 fellow students attend the school pre-MMC and post-MMC were eliminated because Pampel (2000) recommends at least 50 cases per independent variable. Logistic regression relies on maximum likelihood estimation and the reliability of estimates declines significantly for combinations of cases where there are few cases. Therefore, 2,212 records were eliminated from 24 schools for not having 50 fellow students attend the school pre-MMC and post-MMC.

After purging the records according to the criteria described above, 5,158 records of students from 15 area high schools remained to be analyzed in this study. Table 1 shows the demographics of the records analyzed. The 5,158 records used in this study were 48% female and 52% male. The students graduating before the implementation of the MMC represented 36% of the records in the study, and 64% of the student records used in the study graduated after the MMC implementation. The race distribution of the 5,158 records was as follows: White – 76%,

Black/African American – 8%, Hispanic – 8%, and other race groups 7%. The Other race category includes records that selected one of the following races: American Indian/Alaskan Native, Asian, Pacific Islander, Native Hawaiian, or Other.

Table 1

Demographics of Records Analyzed (N= 5,158)

Independent Variable	Categories	Frequency	%
MMC	pre-MMC	1,866	36
	post-MMC	3,292	64
Gender	Females	2,490	48
	Males	2,668	52
Race	Black/African American	422	8
	White	3,941	76
	Hispanic	428	8
	Other	367	7

The Controlled for Variables

The independent variables controlled for in this binomial logistic regression are gender, race, and FRL rate of the school the student graduated from. FRL rate of the high school from which the student graduated is intended to represent the socioeconomic status (SES) of the school environment. The rationale for controlling for gender, race, and FRL rate of the high school from which the student graduated is provided in the publications of Bohrnstedt, et al. (2015), Chapman (2015), Kahlenberg (2013), You (2010), and Zajda & Freeman (2014) and is explained in the literature review.

Instruments

Students entering this community college are placed into college-level courses or remedial-level courses based on their scores on the ACT test, ASSET test, Compass test, or previous college courses taken in high school. Students take the ASSET test if they are entering a

Skilled Trades program. Examples of skilled trades programs include Automotive/Truck Mechanic, Carpenter, Die Maker, Electrician, Metal Model Maker, Millwright, Plumber, Tool Maker, and Wood Pattern Maker. Students take the Compass test if they have not previously taken the ACT or ASSET test before applying to the college. The ACT, Compass, or ASSET test scores serve as a tool to place incoming students into the appropriate college course with the appropriate difficulty level. The goal is to enroll students in courses "that are aptly challenging to their current knowledge level so as not to bore or frustrate, which can lower motivation to perform" (Mattern & Packman, 2009, p. 6).

ACT. The ACT has four sections: English, Math, Reading, and Science. The composite score of all sections range 0-35. The tests are designed to measure the skills that are most important for success in college that are acquired in K12. The tests are developed by analysis of curriculums and state-approved textbooks for grades seven through twelve nationwide and consultations with high school and college educators. Educators are asked to "rate numerous knowledge and skill areas on the basis of their importance to success in entry-level college courses and to indicate which of these areas students should be expected to master before entering the most common entry-level courses" (ACT, 2014, p. 5). The ACT delivers the four sections of the test as follows:

- ACT English section is a 75-item, 45-minute test
- ACT mathematics section is a 60-item, 60-minute test
- ACT reading section is a 40-item, 35-minute test
- ACT science section is a 40-item, 35-minute test

The English section of the test measures "understanding of the conventions of standard written English (punctuation, grammar and usage, and sentence structure) and of rhetorical skills

(strategy, organization, and style)" (ACT, 2014, p. 5). For that reason, the English portion of the ACT test place students into their "writing" class at this college. The science portion scores are not used at this college. The college does not have remedial science courses. Instead, science courses have reading and math pre-requisites that ensure students are able to read the textbook and do the necessary math computations in a science class.

Compass. The Compass test is a computer-adaptive college placement test that lets colleges evaluate incoming students' skill levels immediately. Students do not need to register for the test in advance or show up at a testing site on a specific date. The Compass test is created by ACT and has three sections: reading, writing, and math. It is scored on a scale of 0-100 (ACT, 2012). Like the ACT, the Compass test is also designed to measure the skills that are most important for success in college and is developed in the same way as the ACT with analysis of curriculums and state-approved textbooks for grades seven through twelve nationwide and consultations with high school and college educators.

> The Compass is an adaptive test that ceases to administer items and generates a score report when the desired level of accuracy has been reached or a preset maximum number of items have been administered.… the test will stop even if the maximum-allowed number of items has not been administered. However, the software will always administer at least the minimum number of items specified (ACT, p. 98, 2012).

ASSET. The ASSET has three sections: writing, reading, and math. The tests are designed to measure the skills that are most important for success in college. The ASSET delivers the three sections of the test as follows:

- ASSET reading section is a 24-item, 25-minute test
- ASSET writing section is a 36-item, 25-minute test

- ASSET basic math section is a 32-item, 25-minute test
- ASSET advanced math section is a 25-item, 25-minute test. The advanced math section covers algebra and geometry.

Reliability evidence of the ACT, ASSET, and Compass tests. ACT performs reliability testing on their tests on a regular basis. The most recent report of a reliability test performed on the ACT was in 2014. ACT's (2014) Technical Manual reports the internal consistency reliability coefficients for each section of the test. . Reliability coefficients range from zero to one and are estimates of the consistency of test scores. Values near one indicate greater consistency, and values near zero indicate little or no consistency (ACT, 2014).

- The English section of the test has a reliability coefficient range of .92-.93.
- The math section of the test has a reliability coefficient range of .90-.92.
- The reading section of the test has a reliability coefficient range of .86-.90. (ACT, 2014)

ACT performs reliability testing on the Compass test on a regular basis. The most recent report of a reliability test performed on the Compass was in 2012. ACT's (2012) Compass Technical Manual reports the internal consistency reliability coefficients for each section of the Compass test.

- The writing skills placement section of the test has a reliability coefficient of .88.
- The math placement section of the test has a reliability coefficient range of .85-.88.
- The reading placement section of the test has a reliability coefficient of .87. (ACT, 2012)

ACT performs reliability testing on their tests on a regular basis. The most recent report of a reliability test performed on the ASSET was in 2009. ACT's (2009) research reports the internal consistency reliability coefficients for each section of the ASSET.

- The reading section of the test has a reliability coefficient of .87.
- The math section of the test has a reliability coefficient range of .65-.85.
- The reading section of the test has a reliability coefficient of .78.

(ACT, 2009)

Placement validity evidence of the ACT, ASSET, and Compass tests. The college in this study uses ACT, ASSET, and Compass test scores to make college course placement decisions. ACT (the test company) performs validity testing on the ACT, ASSET, and Compass tests for five of the most common interpretations and uses of the test: "measuring college-bound students' educational achievement in particular subject areas, making college admissions decisions, making college course placement decisions, evaluating the effectiveness of high school college-preparatory programs, and evaluating students' probable success in the first year of college and beyond" (ACT, 2014, p.64). ACT performs the validity testing for making college course placement by collecting course grades from over 100 postsecondary institutions specifically to examine the effectiveness of the ACT, ASSET, and Compass tests for placement. The results of their analyses are summarized by course type. This information provides validity evidence for using ACT, ASSET, and Compass scores for placement and is displayed in the Tables 2-4.

Tables 2-4 display columns for the following: median cutoff score—"the median, across institutions, of the scores that correspond to a .50 probability of getting a B or higher grade in the course" (ACT 2009, p.54); median accuracy rate—"the median, across institutions, of the

estimated percentage of students who would be correctly placed if the cutoff score corresponding to a .50 probability of getting a B or higher grade in the course was used" (ACT 2009, p.54); and median increase in accuracy rate—"the median, across institutions, of the estimated increase in the percentage of students who would be correctly placed due to using the (placement) test and a given cutoff score" (ACT 2009, p.54). The median increase in accuracy rate quantifies the benefit of using the placement test. It provides the comparison of using and not using the test. The cutoff scores presented in Tables 2-4 are not the exact cutoff scores used by the college this study is based on. While Tables 2-4 are used as reference by the college in this study, the next section explains the process used to convert entrance exam scores to ATD rankings.

Table 2

ACT Cutoff Scores and Validity Statistics for Course Placement

Course type	ACT test	Number of institutions	Median cutoff score	Median accuracy rate	Median increase in accuracy rate
Standard composition	English	157	18	67	5
Advanced composition	English	25	20	71	6
Literature	English	11	20	69	9
Intermediate algebra	Mathematics	44	21	69	25
Mathematics					
College algebra	Mathematics	123	22	71	24
Statistics/ Probability	Mathematics	8	23	75	34
Pre-Calculus	Mathematics	32	26	72	38
Trigonometry	Mathematics	29	25	72	32
Calculus	Mathematics	50	27	75	46
American history	Reading	49	22	67	21
Psychology	Reading	44	20	64	7
Writing	Writing	10	6	65	7
English	Writing		18	67	5
English/Writing	Writing		17	69	6

(ACT, 2014, p. 118)

Table 3

ASSET Cutoff Scores and Validity Statistics for Course Placement

Course type	ASSET test	Number of institutions	Median cutoff score	Median accuracy rate	Median increase in accuracy rate
Standard freshman English	Writing	34	41	64	11
Elementary algebra	Numerical Skills	20	44	67	28
Intermediate algebra	Elementary Algebra	7	47	71	36
College algebra	Intermediate Algebra	12	43	67	25
History	Reading Skills	6	47	71	38
Biology	Reading Skills	6	48	69	30
Psychology	Reading Skills	15	44	64	14

(ASSET, 2009, p. 55)

Table 4

Compass Cutoff Scores and Validity Statistics for Course Placement

Course type	Compass test	Number of institutions	Median cutoff score	Median accuracy rate	Median increase in accuracy rate
Composition	Writing	68	71	66	19
Composition	Reading	28	81	60	10
Arithmetic	Numerical Skills	26	36	70	16
Elementary algebra	Numerical Skills	38	62	67	25
Intermediate algebra	Algebra	29	48	71	25
College algebra	Algebra	23	71	72	43
Precalculus	Algebra	6	79	78	53
Calculus	Algebra	6	59	65	24
Biology	Reading Skills	2	90	71	34
History	Reading Skills	5	95	74	47
Psychology	Reading Skills	11	90	68	31

(ACT, 2012, p.22)

Converting test scores to ATD rankings. Scores on the exams described above are converted to an Achieving the Dream (ATD) ranking for math, reading, and writing. The tables in Appendix B provide the equivalent ATD ranking for each test's scores. ATD rankings have the following meanings:

- 0 = Student tested at or above college level
- 1 = Student tested 1 level below college level
- 2 = Student tested 2 levels below college level
- 3 = Student tested 3 or more levels below college level

ATD rankings are added to a student's record immediately upon completing the test. This researcher collapsed the ATD rankings into two groupings: at college level and not at college

level. ATD ranking will be used instead of raw test scores because all students did not take the same test with the same grading scale. Therefore, ATD rankings allow the entrance exam results to be comparable for students who have taken different entrance exams with different scoring scales.

The entrance exam scores are converted to ATD rankings using the conversion tables shown in Appendix B. The tables in Appendix B are created by the faculty who teach the courses below college level and the first course at college level for each subject and the associate dean of the division/department that the classes reside in. Faculty make their informed decisions on entrance exam score conversions to ATD rankings based on their experience in the classroom. For example, the entrance exam score is reviewed in the student record when a student is unsuccessful in a class; and trends are looked for in unsuccessful students' entrance exam scores. The faculty and associate dean also review studies that have examined success in college-level courses with correlating ACT, ASSET, and Compass scores. ACT (2012) provided one such study that correlates Compass test scores with success in college classes. ACT's study produced Table 5 below, which provides the suggested cutoff score for a student to have a 50% chance of earning a B or higher and C or higher.

Teachers and the associate deans take these pieces of evidence into consideration when they establish the conversion tables shown in Appendix B that convert the entrance exam scores to ATD rankings. The ranking is determined on a student-by-student basis depending on what test was taken. Students receive separate rankings for math, writing, and reading. The ATD rankings are stored in student records after taking entrance exams because this college participates in the Achieving the Dream initiative. This study analyzes the ATD rankings for

math, writing, and reading for incoming students. This process of determining ATD ranking is a limitation of the study and will be discussed in the limitations section.

Table 5

Compass Cutoff Score Guide for Placement in First Year College Courses

		Score needed for 50% chance of….	
Course type	Compass test scored	B or higher	C or higher
English			
Composition	Writing Skills	71	29
Composition	Reading	81	55
Mathematics/Business			
Arithmetic	Numerical Skills/Prealgebra	36	31
Elementary algebra	Numerical Skills/Prealgebra	62	40
Intermediate algebra	Algebra	48	28
College algebra	Algebra	71	48
Pre-Calculus	Algebra	79	48
Calculus	College Algebra	59	43
Accounting	Numerical Skills/Prealgebra	65	46
Technical Math	Algebra	40	Not Available
Natural Sciences/Social Studies			
Biology	Reading	90	75
History	Reading	95	88
Psychology	Reading	90	59

(ACT, 2012, p. 24) (Excerpted from ACT Compass Internet Version Reference Manual 2012)

The records of incoming students at the community colleges are divided into two groups. Pre-MMC students who graduated from high school prior to 2011 are in one group: (MMC = 0) n=1,886. Post-MMC students who graduated from high school in 2011 or after are in a second group: (MMC = 1) n = 3,292.

Research Design

This is a non-experimental causal comparative study. The independent variable MMC is the type of high school curriculum received, with two levels: pre-MMC and post-MMC. All students in the first group (graduating class prior to 2011) have not experienced the MMC. All students in the second group (graduating class 2011 and after) have experienced the MMC. The remaining independent variables are gender, race, and FRL rate of the school the student graduated from. The dependent variables are the college-level rankings for math, reading, and writing. Table 6 displays the categories, parameter coding, and frequency for each variable.

Table 6

Categorical Variable Codings

Independent / Predictor Variable	Categories	Parameter coding	Frequency	%
MMC	pre-MMC	0	1,866	36
	post-MMC	1	3,292	64
Gender	Females	0	2,490	48
	Males	1	2,668	52
Black/African American	Not Black/African American	0	4,745	92
	Black/African American	1	422	8
White	Not White	0	1,237	24
(reference variable for race)	White	1	3,941	76
Hispanic	Not Hispanic	0	4,745	92
	Hispanic	1	428	8
Other	Black/African American, White, Hispanic	0	4,797	93
	Asian, Pacific Islander, American Indian	1	119	2
	Other		248	5

You (2010), Zajda & Freeman (2014), and Bohrnstedt et al. (2015) found that gender and race differences contribute to variance in academic performance; therefore, gender and race are controlled for. The FRL rate of the high school the student graduated from is controlled for

because socioeconomic status of the school the student graduated from is a strong predictor of student success (Kahlenberg, 2014).

The binomial logistic regression produces an odds ratio for the MMC's effect on college-level readiness while controlling for race, gender, and FRL. The analysis is performed for each independent variable producing an odds ratio for each independent variable's effect on college-level readiness. The results of the binomial logistic regression are odds ratios for each independent variable's effect on the college-level readiness controlling for the other predictor variables.

Description of Procedures

This study employs a binomial logistic regression for the purpose of describing the independent variables' relationships with the dependent binary variable (ATD Ranking). A binomial logistic regression requires one or more independent variables that can be either continuous or categorical (e.g., MMC, race, gender, and FRL) and one dichotomous dependent variable (ATD Ranking) (Pampel, 2000). The binomial logistic regression is appropriate because the dependent variable (ATD Ranking) has two outcomes (0 = below college level, 1 = at college level). SPSS is used to conduct a binomial logistic regression for each subject (math, writing, and reading).

To make the regression more meaningful, the race data received are collapsed into 4 categories: Black/African American, White, Hispanic, and Other. The subgroups of the collapsed Other category are Asian, Pacific Islander, American Indian, and Other. The percent of records that have designated ethnic groups of Asian, Pacific Islander, and American Indian is 2.2 percent. Therefore, reducing the number of categories to four simplified the model without losing much information.

In a regression, categorical independent variables such as race would be treated as if they have a fixed unit of measurement and assume a linear relation between them (Pampel, 2000) because the race variables are coded numerically (0, 1, 2…). For this study, a linear relationship would be assumed between the race groups: Black/African American, White, Hispanic, and Other. A linear relationship between the race groups does not reflect the actual relationship because the race groups are categories and not linearly related. Therefore, the independent variable is transformed into three dummy variables as shown in the Table 7. White is chosen as the reference variable because it has the highest frequency of the race groups. Frequencies are displayed in Table 6. The use of the dummy variable eliminates the issue of a linear relationship being assumed between the race groups. It enables the regression to assign an odds ratio of likeliness to each categorical independent variable.

Table 7

Race Ethnicity Reclassified into Dummy Variables

	Dummy Variables		
Race/Ethnicity	Other	Black/African American	Hispanic
Other	1	0	0
Black/African American	0	1	0
Hispanic	0	0	1
White	0	0	0

Each record's graduating year field is converted to an MMC field. A student who graduated prior to 2011 has an MMC field of 0; a student who graduated 2011and after has an MMC field of 1. Additionally, the ATD Rankings are collapsed to at college level (1) or not at college level (0). ATD rankings exist for math, reading, and writing. Therefore Math Exam Rankings > 0 (meaning they placed one or more levels below college level) are collapsed to a 0 or not at college level. Math Exam Rankings <= 0 (meaning they placed at college level) are

collapsed to a 1 or at college level. An example of the collapsed data for ATD Ranking is shown in Table 8.

Table 8

Illustration of Collapsing ATD Ranking Data

Original Variable ATD Ranking	New Variable ATD Ranking
-1 (one level above college level)	1 (at college level)
0 (at college level)	1 (at college level)
1 (1 level below college level)	0 (not at college level)
2 (2 levels below college level)	0 (not at college level)

The records of the 5,158 students that fit the criteria for this study have the FRL rate added to them. FRL data was downloaded from Michigan's Department of Education website (Michigan Department of Education, 2015). Each school in Michigan lists the total number of students, the number eligible for a free meal, and the number eligible for a reduced price meal. To determine the FRL rate for the school the student graduated from for this study, the following formula was performed: (#Eligible for free meal + #Eligible for reduced price meal) / Total count. This FRL rate was added to each student's record based on the high school name and the year in which the student graduated. Therefore, the remaining 5,158 records identified the students' 1) college-level ranking for math, reading, and writing; 2) gender; 3) FRL rate of each student's high school; and 4) race.

Data Analysis

Before computing a binomial logistic regression, preliminary analyses are performed to make sure there is a trend in the ATD ranking data worth analyzing further. When the trend is

identified, the data are analyzed with a two-way contingency table analysis to see if the two groups (pre/post MMC) are similar. Specifically, the following two-way contingency tables were created: race group frequency count for MMC groups and gender frequency count for MMC groups.

Subsequently, a forward-solution binomial logistic regression is computed using SPSS, with the predictor variables and categories shown in Table 6. The binomial logistic regression is used to compute an odds ratio of the MMC's effect on college-level readiness, while controlling for FRL rate, gender, and race. A binomial logistic regression was performed for math, reading, and writing.

Anticipated Ethical Issues

The data is stored on the researcher's laptop. Only the researcher has access to it. IRB approval was sought, and this quantitative study is determined exempt and unregulated. Outcome Letter Text: "Based on the information provided, this study involves only coded private information or biological specimens that cannot be linked to a specific individual by the investigator(s) directly or indirectly through a coding system. In accordance with OHRP guidance on this subject, IRB approval is not required as the data cannot be tracked to a human subject." Study eResearch ID:HUM00090125. Date of this Notification from IRB:9/22/2014.

Chapter Four: Research Findings

This quantitative study investigates the effects of the Michigan Merit Curriculum (MMC) on the preparedness for college-level classes for incoming students at a southeast Michigan community college. A binomial logistic regression is performed with the independent variables of high school curriculum (MMC), race, gender, and free/reduced lunch (FRL) rate of the high school the student graduated from. The dependent variable is the students' college-level readiness in math, reading, and writing. The records analyzed in this study belong to 5,158 students who graduated from a Michigan public high school and entered a community college less than one year after graduating from high school between the years of 2008-2014.

Preliminary Findings

Before performing the binomial logistic regression, preliminary analyses are performed in an effort to see if there is a trend in the ATD rankings during the years of the study and to compare the likeness of the populations of the pre-MMC and post-MMC groups. To see if there is a trend in the ATD rankings during the years of the study, the following preliminary analysis are performed:

- Math ATD rankings averaged by year
- Writing ATD rankings averaged by year
- Reading ATD rankings averaged by year

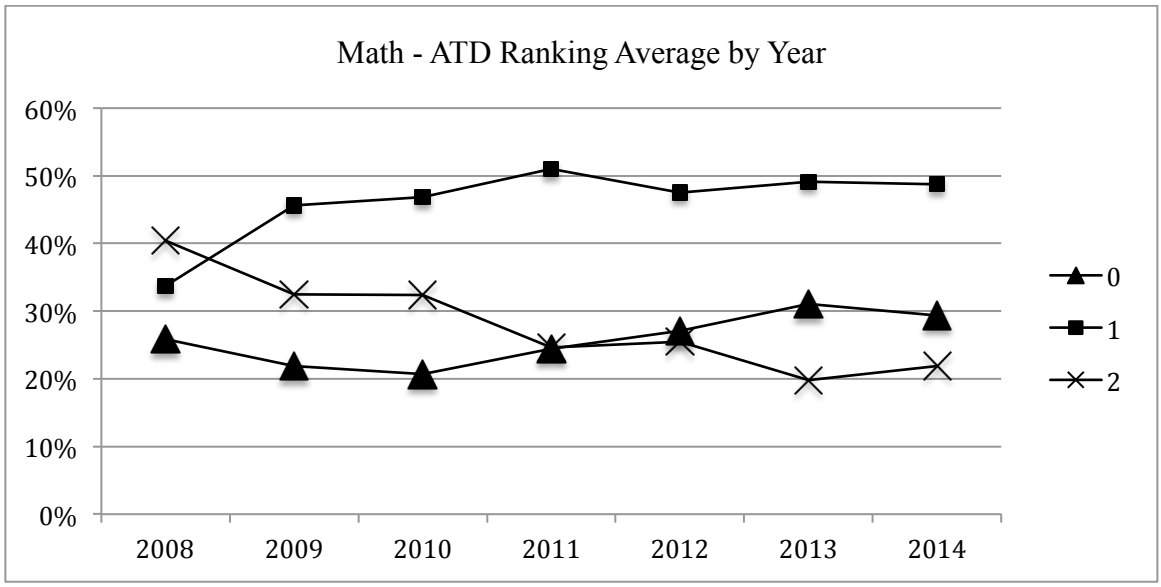
To compare the likeness of the pre-MMC and post-MMC groups, the following preliminary analysis are also performed:

- Racial group percentages of enrolling students by high school graduating year
- Gender of students for each MMC group
- Average FRL rate of the school the enrolling students graduated from by high school graduating year

Math ATD ranking average by year. The math ATD Rankings are averaged for each high school graduation year to see if there is a trend. Figure 2 shows that the percent of entering students with math rankings placing them at college level increased from 2010-2013. Likewise, the percent of students that placed 2 levels below college level dropped from 2008-2013. Table 9 displays the raw data used to create Figure 2.

Figure 2

Math - ATD Ranking Average by Year



0=Student at college level
1=Student 1 level below college level
2=Student 2 levels below college level

Table 9

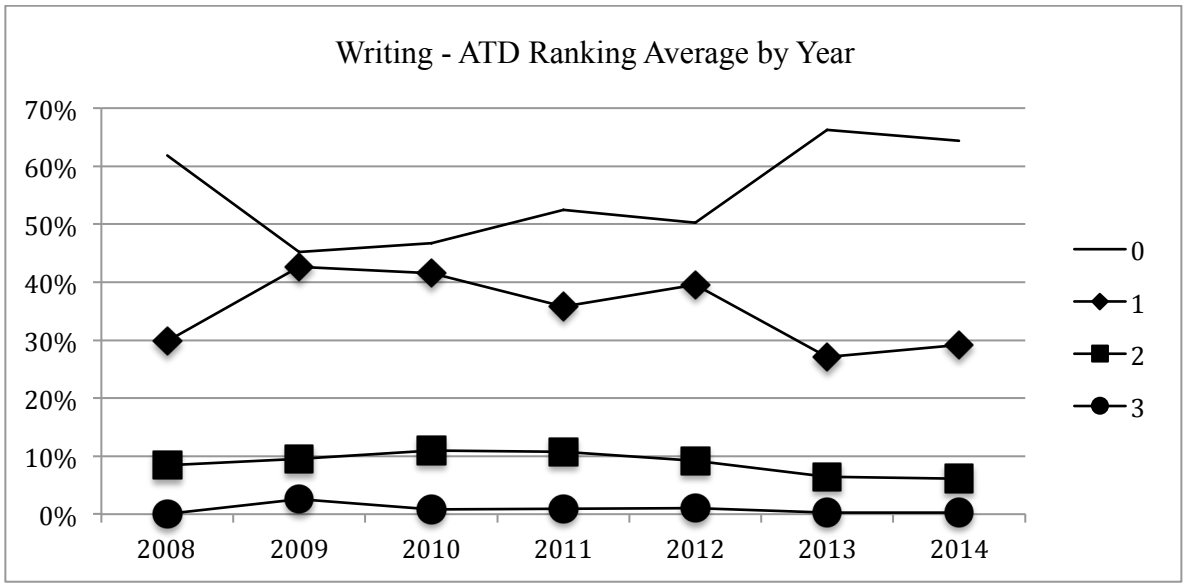
Raw Data Used to Create Math – ATD Graph

Math	2008	2009	2010	2011	2012	2013	2014
0	25.9%	21.9%	20.7%	24.4%	27.1%	31.1%	29.4%
1	33.7%	45.6%	46.9%	51.0%	47.5%	49.1%	48.7%
2	40.4%	32.5%	32.4%	24.6%	25.5%	19.8%	21.9%

Writing ATD ranking average by year. The writing ATD Rankings are averaged for each high school graduation year to see if there is a trend. Figure 3 below shows that the percent of entering students with writing scores placing them at college level (0s) increased from 2011 – 2014. The number of students placing 2 and 3 levels below college level remained flat. Table 10 displays the raw data used to create Figure 3.

Figure 3

Writing - ATD Ranking Average by Year



0=Student at college level
1=Student 1 level below college level
2=Student 2 levels below college level
3=Student 3 levels below college level

Table 10

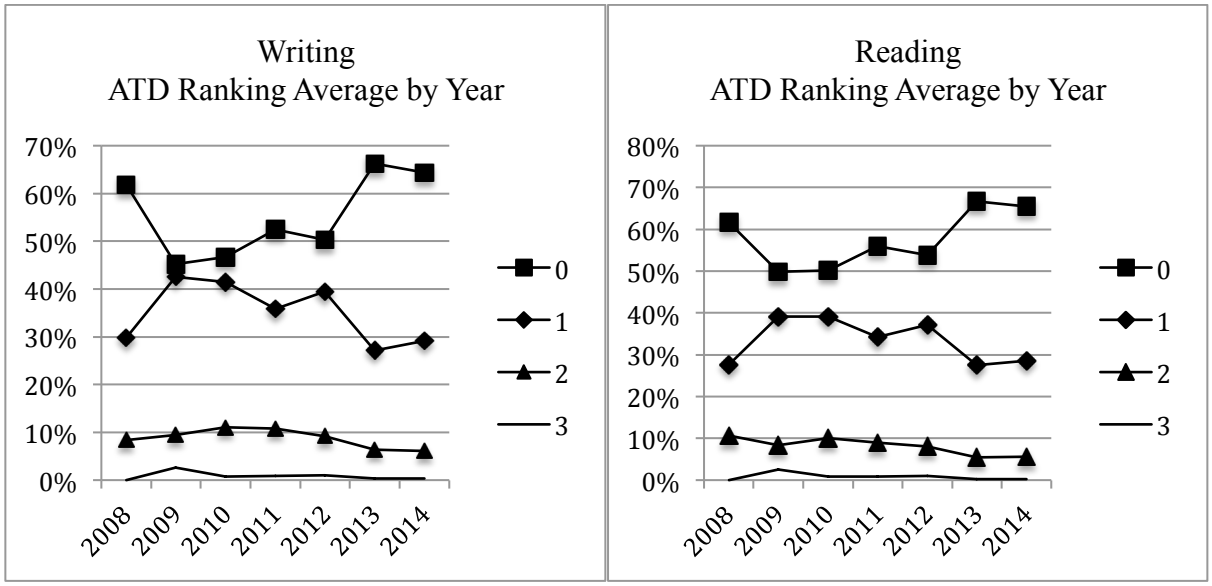
Raw Data Used to Create Writing -- ATD Graph

Writing	2008	2009	2010	2011	2012	2013	2014
0	61.8%	45.2%	46.7%	52.5%	50.3%	66.2%	64.4%
1	29.8%	42.6%	41.5%	35.8%	39.5%	27.1%	29.2%
2	8.4%	9.5%	11.0%	10.8%	9.2%	6.4%	6.1%
3	0.0%	2.6%	0.8%	0.9%	1.0%	0.3%	0.3%

Reading ATD ranking average by year. The reading ATD Rankings are averaged for each high school graduation year to see if there is a trend. The preliminary findings for writing and reading look remarkably similar. For that reason, the reading and writing analysis are displayed side by side in Figure 4. Based on Figure 4, it is easy to see that the scores on these two portions of the test are closely related. Table 11 displays the raw data used to create the right side (reading) of Figure 4. The raw data used to create the left side (writing) is provided in Table 10 above.

Figure 4

Writing and Reading ATD Ranking Averages by Year (Side by Side)



0=Student at college level
1=Student 1 level below college level
2=Student 2 levels below college level
3=Student 3 levels below college level

Table 11

Raw Data Used to Create Reading -- ATD Graphs

Reading	2008	2009	2010	2011	2012	2013	2014
0	61.6%	49.8%	50.1%	55.9%	53.8%	66.7%	65.4%
1	27.7%	39.2%	39.1%	34.3%	37.2%	27.5%	28.6%
2	10.7%	8.4%	10.0%	8.9%	8.0%	5.4%	5.6%
3	0.0%	2.6%	0.8%	0.9%	1.0%	0.3%	0.3%

Figures 2, 3, and 4 are used to see if there is a trend and if the data are worthy of being further analyzed. Because the graphs show evidence of a change in college rankings before and after the MMC was enacted, further data analysis is conducted.

Race of students by year. In an effort to compare the likeness of the sample's racial makeup of the pre-MMC and post-MMC groups, the racial makeup of each class was graphed for each year. Figure 5 below shows the percentage of Black/African American and White students entering this college appeared to remain flat throughout the years included in this study. During the years of the study, the percentage of Hispanic students rose from 5% to 10% of the students entering the college. The Other category was not graphed because the Other group is composed of several race groups with small representation at the college. Table 12 displays the data used to create Figure 5.

Figure 5

Race of Students by High School Graduation Year

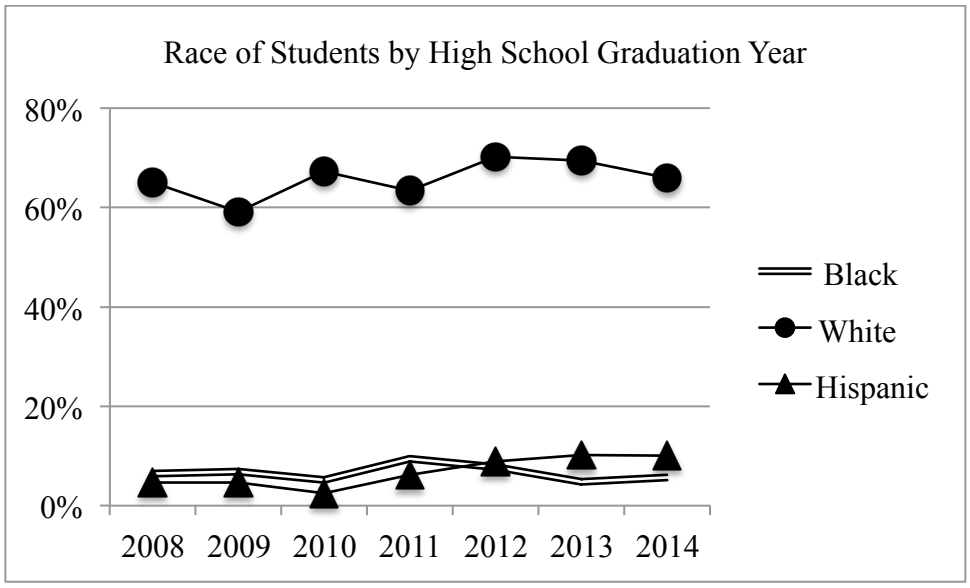


Table 12

Data Used to Create Race / Grad Year Graph

	2008	2009	2010	2011	2012	2013	2014
Black/African American	6.4%	6.8%	5.2%	9.4%	7.8%	4.8%	5.7%
White	65.1%	59.1%	67.3%	63.4%	70.2%	69.4%	65.9%
Hispanic	4.7%	4.7%	2.5%	6.2%	8.9%	10.2%	10.0%

Table 13 shows upon further analysis of the race groups that the pre-MMC and post-MMC groups have a change in the composition of the race makeup. The Black/African American group slightly reduced from 9.1% to 7.7% of their MMC group. Likewise, the White group reduced from 81% to 74% of the MMC group. On the contrary, the Hispanic and Other groups made up more of the post-MMC group than the pre-MMC group. The Hispanic group is 5.8% of the pre-MMC group and 9.7% of the post-MMC group. The Other race group also increased from 4.2% to 8.7%. These data are shown in Table 13.

Table 13

Race Group Frequency Count for MMC Groups

		MMC		
		Pre	Post	Total
Black/African American	Count	170	252	422
% within MMC		9.1%	7.7%	8.2%
White	Count	1,508	2,433	3,941
% within MMC		80.8%	73.9%	76.4%
Hispanic	Count	109	319	428
% within MMC		5.8%	9.7%	8.3%
Other	Count	79	288	367
% within MMC		4.2%	8.7%	7.1%
Total	Count	1,866	3,292	5,158

A two-way contingency table analysis is conducted to evaluate whether the race groups in the pre- and post-MMC groups have the same makeup. The two variables are race and MMC. Race has four categories (Black/African American, White, Hispanic, and Other). MMC has two categories (pre-MMC and post-MMC). Race and MMC are found to be significantly related, Pearson χ^2 (3, N = 5,158) = 65.9, $p < .001$, Cramer's V =.113. This finding confirms that there is a difference in the racial makeups of the pre-MMC and post-MMC groups as described above. This is evidence that race must be controlled for in the binomial logistic regression.

Gender of students for each MMC group. A two-way contingency table analysis is conducted to evaluate whether the gender groups in the pre- and post-MMC groups have the same makeup. The two variables are gender and MMC. Race has two categories (Male and Female). MMC has two categories (pre-MMC and post-MMC). The pre-MMC and post-MMC groups do not have a change in the composition of the Gender makeup, as shown in Table 14.

Gender and MMC are not found to be significantly related, Pearson χ^2 (1, N = 5,158) = 95.1, p < .01, Cramer's V =.001.

Table 14

Gender Frequency Count for MMC Groups

		MMC		
		Pre	Post	Total
Female	Count	1,102	1,431	2,533
	% within MMC	49.1%	49.1%	49.1%
Male	Count	1,142	1,483	2,625
	% within MMC	50.9%	50.9%	50.9%
	Total Count	2,244	2,914	5,158

Average FRL rate by high school graduating year. In an effort to compare the likeness of the FRL rate of the high school from which the students graduated over the years of the study, the FRL rates of the schools the students graduated from are averaged for each graduation year and graphed for each year. Figure 6 below shows the average FRL rate of the students in the study rose during the course of this study from 40% in 2008 to 50% in 2011 to 60% in 2014. This rise may be a reflection of Michigan's economic turbulence from 2008-2012 as illustrated in Figure 1 in the introduction. This is evidence that supports controlling for FRL rate in the binomial logistic regression. Table 15 displays the raw data used in creating Figure 6.

Figure 6

Average FRL Rate by High School Graduating Year

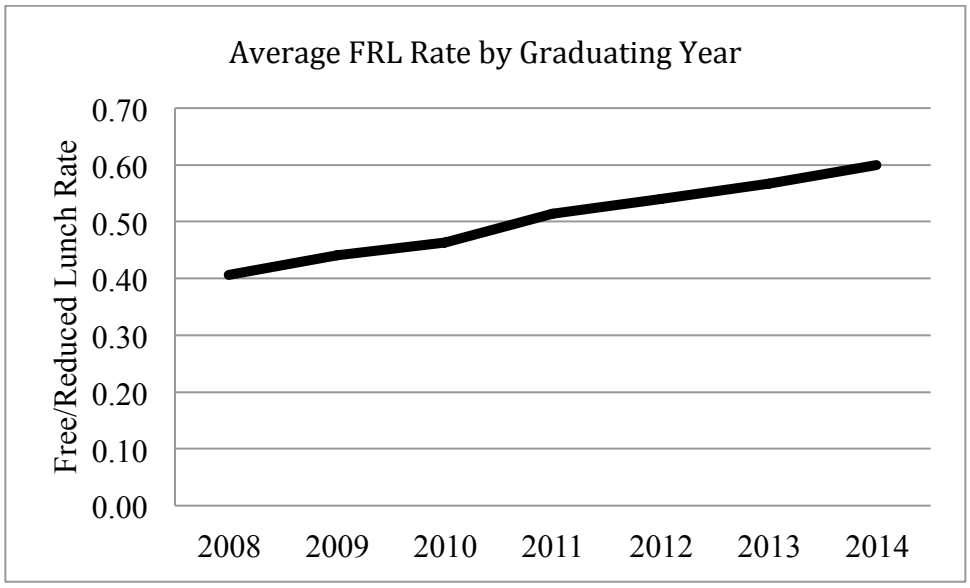


Table 15

Data Used to Create FRL / Grad Year Graph

2008	2009	2010	2011	2012	2013	2014
0.41	0.44	0.46	0.51	0.54	0.57	0.60

The change in FRL rate is confirmed with an independent samples t-test, which is performed for the FRL rate and the MMC. There is homogeneity of variances, as assessed by Lavene's test for equality of variances (p = .568). The post-MMC mean FRL rate is 0.11 higher, 95% CI [-.122 to 0.102] than the pre-MMC mean FRL rate. There is a statistically significant difference in mean FRL rate between pre-MMC and post-MMC, $t(5,156) = -21.95$, $p < .001$. This provides further evidence to control for the FRL rate.

Summary of the preliminary findings. The purpose of the preliminary analysis is to look at the trends to see if the data warrants further analysis. The trends in Figures 2, 3, and 4 warrant an analysis of the records with a regression. A binomial logistic regression will be used

because it provides an odds likeliness ratio that an observation falls into one of two categories of a dichotomous dependent variable (college ready) based on one or more independent variables that can be either continuous or categorical.

The second purpose of the preliminary analysis is to compare the likeness of the populations of the pre-MMC and post-MMC groups. The preliminary analysis found race and MMC to be significantly related. Therefore, there is a difference in the racial makeups of the pre-MMC and post-MMC groups. Additionally, the preliminary finding indicates the FRL rate did change for the pre-MMC and post-MMC groups. The difference in the racial makeup and FRL rate and gender of the two groups makes it important to control for race and FRL rate.

Binomial Logistic Regressions Findings

Three binomial logistic regressions are performed on the student records using SPSS, one for each of the following: math, writing, and reading. The results are discussed here. An alpha level of .05 is used to determine significance. The significance level (α level) is the probability of making the wrong decision when the null hypothesis is true.

Math results. A binomial logistic regression is performed on the students' records using SPSS with the math ATD ranking variable as the dependent variable and gender, race, FRL Rate, and MMC variables as the independent variables. An explanation of the results is discussed here.

Model fit and variance explained. Based on the omnibus chi-square test, the logistic regression model for math is statistically significant, $\chi^2(6) = 193.15$, $p < .001$. The low p value indicates the relationship between the math ATD rankings and the MMC, gender, race, and FRL rate has a less than .1% chance that it is due to random chance. When the Cox & Snell R^2 and Nagelkerke R^2 values are consulted for the logistic regression for math, the model summary shows the explained variation in the dependent variable based on the model ranges from 13% to

19%. The math Cox & Snell R^2 and Nagelkerke R^2 values are much higher than the Cox & Snell R^2 and Nagelkerke R^2 values for reading and writing (4.1-7.4%) discussed in the next sections.

Category prediction. Table 16 shows each of the independent variables are statistically significant except for the Other race variable. This is based on the results of: gender ($p < .001$), MMC ($p < .001$), FRL ($p < .001$), Black/African American ($p < .001$), and Hispanic ($p < .001$). Therefore, each of these predictor variables significantly predicted the outcome variable, Math College Ready. The Other ($p = .182$) race dummy variable is not a significant predictor of the outcome variable.

Table 16

Independent Variables in Model - Math

Variable	B	S.E.	Wald Statistic	df	*p*	Exp(B)
Gender	.342	.065	27.660	1	.000	1.408
FRL	-.064	.018	12.311	1	.000	.938
MMC	.360	.072	25.037	1	.000	1.433
Hispanic	.-.747	.134	31.024	1	.000	.474
Other	-.167	.125	1.778	1	.182	.846
Black/African American	-1.597	.190	70.390	1	.000	.203
Constant	-1.011	.098	106.999	1	.000	.364

The "Exp(B)" column in Table 16 and 17 informs of the change in the odds ratio for each increase in one unit of the independent variable. For example, after controlling for all other variables in the model, an increase in one unit of gender (i.e., being male) increases the odds ratio by 1.408. This means the odds of being at college level in math is 1.408 times greater for males than females. The remaining variable's odds ratio results are shown in Table 17.

Table 17

Summary of Odds Ratio Result for Math

Variable	Exp(B)	Results
Gender	1.408	A male student is 1.408 times more likely to be at college level in math than a female student.
MMC	1.433	A student who experienced the MMC is 1.433 times more likely to be at college level in math than a student who has not experienced the MMC.
FRL	.938	For each decrease of the FRL rate by 10%, a student's odds of being at college level in math are 1.07 (=1/.938) times greater.
Black/African American	.203	A White student is 4.93 (=1/.203) times more likely than a Black/African American student of being at college level for math.
Hispanic	.474	A White student is 2.11 (=1/.474) times more likely than a Hispanic student to be at college level in math.

Summary of results for math. A binomial logistic regression is performed to examine the effects of MMC, gender, race, and FRL rate of the high school the student graduated from on the likelihood that participants are at college level for math. The logistic regression model is statistically significant, $\chi^2(6) = 193.15$, $p < .001$, There is a less than .1% chance that the relationship between the independent variables and dependent variable is due to random chance. Of the predictor variables, all are statistically significant: gender, FRL and MMC, and race except Other in the race category.

Male students have 1.408 times higher odds to be college level than female students. Decreased FRL of the school the student graduated from is associated with an increased likelihood of being college level. Students who experienced the MMC have 1.433 times higher odds of being college level as opposed to those that did not. Being a White student as opposed to a Black/African American student increases the odds of being at college level by a factor of 4.93,

and being a White student as opposed to a Hispanic student increases the odds of being at college level by a factor of 2.11.

Writing results. A binomial logistic regression is performed on the students' records with the writing ATD ranking variable as the dependent variable and gender, race, FRL Rate, and MMC variables as the independent variables. An explanation of the results is discussed here.

Model fit and variance explained. The omnibus chi-square test indicates the model is statistically significant $\chi^2(6) = 214.95$, $p < .001$. The model summary shows the explained variation in the dependent variable based on the model ranges from 4.1% to 5.5%, depending on whether you reference the Cox & Snell R^2 or Nagelkerke R^2 methods.

Category prediction. According to Table 18, gender ($p < .001$), MMC ($p < .001$), FRL ($p < .001$), Black/African American ($p < .01$), and Hispanic ($p < .001$) were significant predictors of college readiness in writing. The Other variable ($p = .234$) is not a significant predictor of the writing college readiness variable.

Table 18

Independent Variables in Model - Writing

	B	S.E.	Wald Statistic	df	*p*	Exp(B)
Gender	-.245	.058	18.153	1	.000	.797
FRL	-.099	.017	35.478	1	.000	.905
MMC	.414	.063	43.189	1	.000	1.513
Hispanic	-.517	.103	25.080	1	.000	.592
Other	-.230	.111	4.287	1	.234	.797
Black/African American	-1.191	.111	114.968	1	.008	.304
Constant	.715	.088	65.881	1	.000	2.116

Referring to the "Exp(B)" column in Table 18 and 19, after controlling for all the other variables in the model, the odds of being at college level in writing is .797 as likely for males as opposed to females, or a female is 1.25 (=1/.797) times more likely to be at college level in writing than a male. The odds of being college level in writing is 1.513 times greater for students who experienced the MMC as opposed to those that did not. Each of the independent variables odds ratios is displayed in the Table 19 for writing.

Table 19

Summary of Odds Ratio for Writing

	Exp(B)	Writing Results
Gender	.797	A female student is 1.25 (=1/.797) times more likely to be at college level in writing than a male student.
MMC	1.513	A student who experienced the MMC is 1.513 times more likely to be at college level in writing than a student who has not experienced the MMC.
FRL	.905	For each decrease of the FRL rate by 10%, a student's odds of being at college level in writing is 1.10 (=1/.905) times greater.
Black/African American	.304	A White student is 3.29 (=1/.304) times more likely than a Black/African American student of being at college level for writing.
Hispanic	.592	A White student is 1.69 (=1/.592) times more likely than a Hispanic student to be at college level in writing.

Summary of results for writing. A binomial logistic regression is performed to ascertain the effects of MMC, gender, race, and FRL rate of the high school the student graduated from on the likelihood that participants are at college level for writing. The logistic regression model is statistically significant, $\chi^2(6) = 214.95$, $p < .001$. All the predictor variables are statistically significant: gender, FRL, race, and MMC except for the race category Other. Males are .797 as likely to be college level in writing as females. Decreased FRL is associated with an increased likelihood of being college level. Students who experienced the MMC have 1.513 times higher odds of being at college level as opposed to those that do not. Whites are 1.69 times more likely to be at college level than Hispanics, and Whites are 3.29 times more likely to be at college level than Black/African Americans.

Reading results. A binomial logistic regression is performed on the students' records with the reading ATD ranking variable as the dependent variable and gender, race, FRL Rate, and MMC variables as the independent variables. An explanation of the results is discussed here.

Model fit and variance explained. The omnibus chi-square test indicates the reading model is statistically significant, $\chi^2(6) = 291.072$, $p < .001$. The explained variation in the dependent variable based on the model ranges from 5.5% to 7.4%, depending on whether Cox & Snell R^2 or Nagelkerke R^2 is referenced.

Category prediction. Table 20 shows the statistical significance for each of the independent variables. Similar to math and writing, the reading results show that gender ($p < .05$), MMC ($p < .001$), FRL ($p < .001$), Black/African American ($p < .001$), White ($p < .001$), Hispanic ($p < .001$), and Other ($p <. 001$) were significant predictors of the reading college readiness variable.

Table 20

Independent Variables in the Model - Reading

	B	S.E.	Wald Statistic	df	*p*	Exp(B)
Gender	-.118	.052	3.987	1	.046	0.888
FRL	-.160	.151	87.566	1	.000	.852
MMC	.462	.057	51.777	1	.000	1.576
Hispanic	-.495	.104	22.761	1	.000	.605
Other	-.403	.062	13.110	1	.000	.711
Black/African American	-1.355	.112	145.635	1	.000	.258
Constant	1.040	.091	132.120	1	.000	2.830

Table 20 and 21 provides the odds ratio for each independent variable. A female is 1.13 (=1/.888) more likely to be at college level in reading than a male. For MMC, an increase in one unit (i.e., having had MMC) increases the odds ratio by 1.576. Therefore, the odds of being college level in reading is 1.576 times greater for students who experienced the MMC as

opposed to those that did not. Each of the independent variables odds ratios is displayed in Table 21.

Table 21

Summary of Odds Ratio Results for Reading

Variable	Exp(B)	Results
Gender	.888	A female student is 1.13 (=1/.888) times more likely to be at college level in reading than a male student.
MMC	1.576	A student who experienced the MMC is 1.576 times more likely to be at college level in reading than a student who has not experienced the MMC.
FRL	.852	For each decrease of the FRL rate by 10%, a student's odds of being at college level in reading is 1.17 (=1/.852) times greater.
Black/African American	.258	A White student is 3.88 (=1/.258) times more likely than a Black/African American student of being at college level for reading.
Hispanic	.605	A White student is 1.65 (=1/.605) times more likely than a Hispanic student to be at college level in reading.

Summary of results for reading. A binomial logistic regression is performed to examine the effects of MMC, gender, race, and FRL rate at high school graduated from on the likelihood that participants are at college level for reading. The logistic regression model is statistically significant, $\chi^2(6) = 291.072$, $p < .001$. All the predictor variables are statistically significant: gender, FRL and MMC, and all categories of race. Females are 1.13 times more likely as males to be at college level for reading. Decreased FRL is associated with an increased likelihood of being college level. Students who experienced the MMC have 1.576 times higher odds of being at college level as opposed to those that did not. Whites are 3.88 times more likely to be college level in reading than Black/African Americans, and Whites are 1.65 times more likely to be college level in reading than Hispanics.

Collective findings for all three subjects. Looking at all three subjects together in Table 22, the regression suggests that the MMC makes students approximately 1.5 times more likely to be at college level for all three subjects when controlling for all other variables in the model. A log model equation is not provided because the purpose of this logistic regression is to describe data and to explain the relationship between one binary dependent variable (ATD Ranking) and the independent variables. Those relationships are described in Table 22.

The directional hypothesis posited that the state-mandated high school curriculum will make students better prepared for college math, writing, and reading courses as evidenced by ATD rankings. The null hypothesis posited that there would be no difference in the levels of student preparedness for math, reading, and writing college-level courses between those students that completed high school before the implementation of the MMC curriculum and those students that completed high school after the implementation of the MMC curriculum. The null hypothesis is rejected and the directional hypothesis is accepted based on the findings of this study. Table 22 summarizes the odds ratio results.

Table 22

Summary of Odds Ratio Results for Reading, Writing, and Math

Variable	Exp(B) Reading	Exp(B) Writing	Exp(B) Math	Results
Gender	.888	.797	1.408	Females are more likely to be at college level for reading and writing than males. Males are 1.408 more likely than females to be at college level for math.
MMC	1.576	1.513	1.433	Students who experienced the MMC are consistently about 1.5 times more likely to be at college level for reading, writing, and math than students who did not experience the MMC.
FRL	.852	.905	.938	Decreased FRL of the school the student graduated from is associated with an increased likelihood of being at college level for reading, writing, and math.
Black/African American	.258	.304	.203	Black/African American students are less likely than White students to be at college level for reading, writing, and math.
Hispanic	.605	.592	.474	Hispanic students are less likely than White students to be at college level for reading, writing, and math.

Chapter Five: Discussion, Recommendations, and Conclusions

The current study reports the effects of a state-mandated high school curriculum on student preparedness for college-level classes. It is a quantitative study of students' ATD rankings, which indicate whether a student is at college-level in math, reading, or writing, before and after the implementation of the Michigan Merit Curriculum (MMC). The first high school graduating class required to meet the MMC standards was the class of 2011. The data in this research were collected by the research department of the participating community college for incoming students graduating from high school in years 2008 to 2014.

Discussion

The legality of free public high schools in Michigan was decided by the Kalamazoo, Michigan court case, *Stuart et al. v. Kalamazoo, 1874*, which upheld public schools must be provided for 14-17 year olds (Burrell & Eckelberry, 1934). Long before *Stuart et al. v. Kalamazoo, 1874*, Horace Mann, Massachusetts' Secretary of Education, stated in his 1848 Report on Education to the state of Massachusetts, "Education, then, beyond all other devices of human origin, is the great equalizer of the conditions of men, —the balance-wheel of the social machinery" (Mann, 1848, p.669). He said this in context of his argument that public education should be funded and provided for all students. In 1894, the Committee of Ten took Mann's argument further when they created a report with the recommendation that all public high school students study the same curriculum. The Committee of Ten was charged with conferencing and reporting the appropriate high school curriculum by the National Education Association in 1894 (National Education Association, 1894). The recommendation in the report was substantiated

with an explanation that even though an insignificant number of high school graduates will go on to college, secondary schools exist to prepare students for the duties of life. The Committee of Ten report further substantiated a college preparatory curriculum for all with the argument that parents do not know four years before their child reaches college age if they will send their child to college. Furthermore, students may not know their future educational plans until near the end of their high school career. The committee wanted all graduates of a high school to have the knowledge base necessary to proceed on to college regardless of the timing of their decision to continue their education (National Education Association, 1894).

In the year 2016, public high school continues to be provided for all, but is it an equalizer? Oakes & Guiton studied high school tracking decisions and found a student's race, ethnicity, and social class play a role in the type of high school classes in which a student enrolls. Students from low SES households, Hispanic students, and Black/African American students are less likely than White students from higher SES households to enroll in college preparatory classes in high school if their high school offers them. Oakes & Guiton (1995) explain factors that keep students from low SES households, Hispanic students, and Black/African American students from enrolling in college preparatory classes in high school include counselors passing judgment on a student based on dress, behavior patterns, and speech; peer influences; parent demands; and teacher expectations. Oakes & Guiton's (1995) study also found that it is rare for a student's track to change upon entrance to high school. "Once placed in a particular track or ability level of a course, students tend to be placed similarly in subsequent years (p.14)." Oakes & Guiton (1995) researched tracking decisions at four California high schools. The teachers and high school administrators explained to Oakes & Guiton (1995) the common practice used to place students in the most appropriate high school classes for their ability. An elaborate

procedure is followed for evaluating test scores and junior high school teacher recommendations for incoming high school students. Incoming students are placed in the most appropriate high school classes for their ability based on the evaluation. These decisions are never revisited after initial entry to high school.

> What made these recommendations and initial judgments so powerful was the widespread belief that a student's educational prospects are virtually set by the time he or she gets to high school. Many considered motivation and intellectual ability to be fixed attributes over which educators have little control (Oakes & Guiton, p.10, 1995).

In addition to high school tracking decisions creating disparity among students' high school curriculum, school financing limitations also create disparities in students' educational opportunities. Michigan legislators attempted to address the disparity in school offerings and funding in 1994 when the Alpena school district ran out of money in the seventh month of the academic school year and declared its school year over. Michigan voters approved a plan in 1994 that overhauled school financing in Michigan. The previous school financing model relied heavily on local property taxes within each district financing local schools, which resulted in large disparities among school districts in the amount of per pupil spending for educational purposes. Part of the 1994 overhaul was increasing the state sales tax from 4% to 6% and increasing the cigarette tax. The overhaul shifted school funding from local government to state government. The result was school districts with smaller tax bases were no longer at a disadvantage to school districts with larger tax bases in education finances. Two of the intended results were elimination of inferior education for children in the property-poor districts and more equitable distribution of course offerings across districts (Greene, 1995).

However, 12 years after the school financing overhaul that was intended to eliminate disparities among school districts' finances, large disparities in high school curriculums still existed. A survey of Michigan school districts in 2006 found less than one-third of the state's 770 districts required algebra I to earn a high school diploma; and a little more than one-third required students to pass a biology course (Shakrani, 2006). This disparity in graduation requirements coupled with the exodus of jobs from Michigan that did not require a college degree were two of the incentives to write and pass the MMC. The MMC instituted a state-mandated curriculum that removes high school course registration biases based on SES, race, ethnicity, or school district. The MMC gives all students the same high school curriculum and is a return to the intentions of Mann and the Committee of Ten.

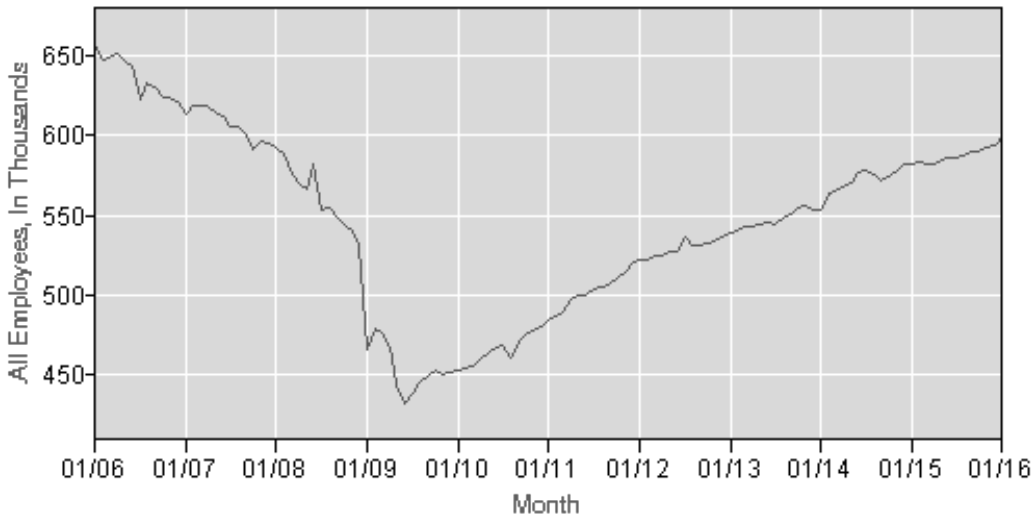
The exodus of employment opportunities from Michigan that do not require a college degree made a college degree much more necessary to earn a living wage in Michigan (Michigan Department of Education, 2007). An example of how difficult it is to earn a living wage without a college degree has been discussed in the news often recently with the debate about a $15 minimum wage (Davidson, 2016). Unions and community organizers have staged strikes and protests to publicize how difficult it is to live on the typical minimum wage (CBS News, 2015). Michigan's loss of manufacturing jobs depleted the employment opportunities that paid a living wage without a college degree. Michigan lawmakers were adamant that a college degree was necessary to secure well-paying employment in Michigan when the manufacturing jobs vanished from Michigan (Michigan Department of Education, 2007). The MMC targeted students who would not have been on a college preparatory track and mandated their high school curriculum include college preparatory course sequences of four credits of math; four credits of science; four credits of English language arts; three credits of social studies; one credit of physical education

and health; one credit of visual, performing, and applied arts; and an online learning experience. Consequently, the MMC was eliminating the influences of SES; race; peers; parent expectations; and counselors subjective judgment of students' dress, behavior patterns, and speech on curriculum selection.

The college used in the current study is an ideal setting to investigate the effects of the MMC because of the following: 1) it is a community college, 2) size of both the Black/African American and the Hispanic groups are each 8% of the sample, 3) the overall sample size of study is large (n=5158), and 4) the students in the sample attended public high schools with average free and reduced lunch (FRL) rates of 41-60% over the years of the study. The location of this college is in the heart of the automotive industry. The suburb in which this college is located had provided manufacturing jobs throughout the twentieth century that did not require a four-year college degree. The manufacturing jobs exited Michigan (Figure 7) along with the retail and service jobs that supported them.

Figure 7

Michigan Statewide Manufacturing Employees 2006-2016



(United States Department of Labor, 2016)

The MMC had an effect on this sample of students from high schools with above average FRL rates. The narrow set of mandated academic courses had positive academic benefits for the students at this community college setting. The students in the current study who completed the MMC were 1.5 times more likely to place into college-level classes in the areas of math, reading, and writing than students who graduated from high school before the MMC was implemented in 2006.

The students in the current study that experienced the MMC in high school were 1.5 times less likely to need remedial courses in math, writing, or reading. A student who is 1.5 times less likely to need one or more remedial classes is 1.5 times less likely to pay the tuition for each remedial reading, writing and math class they don't need. Seven years of entering students' records were included in the current study. The sample included an average of 775 students each year that had graduated from a Michigan public high school. The three years before the MMC was instituted, 77% of students were required to enroll in remedial math, 48% were required to enroll in remedial writing, and 46% were required to enroll in remedial reading. At the community college in the current study, 72% of the students receive a federal Pell Grant to pay for tuition. The findings of the current study suggest legislation focused on raising academic achievement in high school curriculums has resulted in saving citizens $210,000 in tuition. Likewise, taxpayers potentially saved $151,000 in Pell Grants at this southeast Michigan community college. Table 23 displays the math that derives these numbers.

Table 23

Estimate of Potential Tuition Savings for One Year as a Result of the MMC

Subject	Enrollment of Recent Public High School Graduates[1]	Students Placing in Remedial Class pre-MMC	Students Placing in Remedial Class post-MMC	Potential Tuition Savings[2]	Potential Federal Pell Grant Savings[3]
Math	775	597	398	94,326	68,000
Reading	775	357	238	56,406	40,600
Writing	775	372	248	58,776	42,300
			Totals	209,508	150,844

[1]Seven-year average 2008-2014
[2] Based on $474 tuition per one 3-credit class, in-state tuition
[3]72% Federal Pell Grant recipients

At a time when politicians, educators, parents, and taxpayers are looking for ways to stretch taxpayer money spent on education, a student being 1.5 times more likely to enroll in college level classes cannot be dismissed. This consistent increase across reading, writing, and math indicates the MMC legislation saved students and taxpayers tuition and Pell Grant money. Additionally, if the manufacturing, service, and retail jobs that were obtainable without a college education no longer exist in Michigan, the MMC has made obtaining the jobs that require a college degree more attainable for students who would not have otherwise taken a college preparatory curriculum in high school. Strong American Schools (2008) found only 29% of students who enter college with a need to take remedial classes, before college-level classes, graduate college within eight years. The MMC has reduced the number of students needing to take remedial classes by 1.5 times; therefore, the students who completed the MMC and do not need remediation are more likely to graduate from college. The jobs remaining in Michigan after the manufacturing jobs diminished required a college degree. The students completing the MMC are more likely to obtain the jobs in Michigan that require a college degree.

Findings

The findings of this study show that community college students are better prepared for college-level courses if they have experienced a high school curriculum that includes a four-credit math course sequence, a three-credit science course sequence, four credits of English language arts, and three credits of social studies, as evidenced by students who have experienced the MMC at a southeast Michigan community college. They are less likely to require remedial education in college reading, writing, and math courses. The null hypothesis posited that there would be no difference in the levels of student preparedness for math, reading, and writing college-level courses between those students that completed high school before implementation of the MMC curriculum and those students that completed high school after implementation of the MMC curriculum. The null hypothesis is rejected because the study's findings showed a difference in the levels of student preparedness for math, reading, and writing college-level courses between those students that completed high school before implementation of the MMC curriculum and those students that completed high school after implementation of the MMC curriculum. The directional hypothesis posited the state-mandated high school curriculum would make students better prepared for college math, writing, and reading courses as evidenced by ATD rankings. The study's findings showed a difference between those that completed high school before implementation of the MMC curriculum and those students that completed high school after the implementation of the MMC curriculum so the directional hypothesis is accepted.

Findings related to literature.-The literature on mandatory college preparatory high school curriculums had mixed findings with regards to improving student achievement. Studies with samples pulled from nationally representative data or state representative data did not

discover student achievement improved with a mandatory college preparatory high school curriculum. Studies with samples that involved community college students or disadvantaged students discovered student achievement improved with a mandatory college preparatory high school curriculum. The current study's sample consists of community college students and corroborates the findings of Cousineau (2012), whose study also included community college students.

Carlson & Planty (2012) studied constrained curriculums on a nationally representative sample of students and found increased graduation requirements to be ineffective based on standardized test scores. When studying community college students in a diverse urban area from schools with higher than average FRL rates, the author of the current study has different findings. Community college students are more likely than a nationally representative sample of students to benefit from a state-mandated college preparatory curriculum because a nationally representative sample of students has more students who are already on a college-preparatory path and taking the courses in the state-mandated curriculum than a sample of students attending a community college (Benson, 2010). Additionally, the setting of this author's study has a higher than national average FRL rate. In the last year of the current study, the 2013-2014 school year, the state-wide average in Michigan public schools of students eligible for free or reduced lunch was 48% (Michigan Department of Education, 2015). The students in the sample for the current study graduated from high schools with an average of 60% of the students eligible for free or reduced lunch. Students from high schools with higher FRL rates are less likely to enroll in college preparatory classes (Oakes & Guiton, 1995). The MMC had a greater effect on the sample in the current study because it is not a nationally representative sample of students; it is a sample of students who historically are less likely to enroll in college preparatory classes.

In 2012, the Michigan Consortium for Educational Research performed a study on the MMC using administrative data from the State of Michigan for first-time ninth grade students from the academic year (AY) 2004-05 to 2011 and found that all students had experienced declines in writing scores (Dynarski et al. p.4, 2012). The Michigan Consortium for Educational Research revisited the effect of the MMC in 2016. Jacob, Dynarski, Frank, & Schneider (2016, p.11) found "the introduction of the MMC had a small positive effect on science achievement and little evidence of any effect in other subjects."

The results of the current study with community college students do not confirm the findings of the Michigan Consortium for Educational Research. Community college students' test scores are positively impacted by the MMC in math, reading, and writing. The current study found the community college students who experienced the MMC were 1.5 times more likely to place into college-level math, reading, and writing courses. Like Carlson & Planty (2012) who used a nationally representative sample of students in their study, Dynarski et al. (2012) and Jacob et al. (2016) used state-wide representative data. Like Carlson & Planty (2012), Dynarski et al. (2012) and Jacob et al. (2016) did not find improvements in exam scores for math, reading, and writing on the state-wide representative data after the rigorous high school curriculum was mandated. Dynarski et al. (2012) found declines in writing scores and Jacob et al. (2016) found only a small positive effect on science achievement. The population sample studied to see the effect of the MMC makes a difference.

In 2002, the No Child Left Behind Act (NCLB) (U.S. Government, 2002) reauthorized the Elementary and Secondary Education Act, which was originally enacted in 1965. NCLB was reauthorized as the Every Student Succeeds Act in 2015 (U.S. Government, 2015). NCLB intended to close the achievement gap in K12 education for disadvantaged students by

mandating schools that receive federal funding implement measures that would ensure students from all groups meet high academic standards. Those measures included K12 schools having clear, measurable goals focused on basic skills and essential knowledge; requiring annual testing in every grade; expecting adequate yearly progress for disadvantaged students; providing corrective action for low-performing schools; rewarding schools that narrow the achievement gap; and putting in place consequences for failure (Bush, 2001). NCLB pledged to eliminate the achievement gap between students that historically have performed at lower levels by the 2013-2014 academic year. "Title I—Improving the academic achievement of the disadvantaged" (No Child Left Behind Act, 2002, p.1) placed a spotlight on the lowest academic achievers. Under NCLB, schools were no longer only measured by the achievement of their general populations. NCLB put a spotlight on the academic achievement of racial groups, ethnic groups, socio-economically disadvantaged students, English language learners, and children with disabilities (Young, 2013).

It is important to study the general populations as Dynarski et al. (2012) and Jacob et al. (2016) did. Understanding how the general population of students has been effected by the MMC identifies unintended consequences of legislation that was focused on students who would not have taken a four-credit math course sequence, a three-credit science course sequence, four credits of English language arts, and three credits of social studies without the MMC.

A feared unintended consequence of the MMC was an increase in the high school drop-out rate before graduation. Craft (2008) spoke of this fear during the MMC implementation. The Michigan Consortium for Educational Research studied the early effects of the MMC in 2011 and estimated the MMC was "associated with a decline in the four-year high school graduation rate of about two percentage points (off of a base of 72 percent)" (Dynarski et al., p.4, 2012).

The MMC also appears to have extended the stay in high school beyond the traditional four years (Dynarski et al., 2012). In 2016, Jacob et al. found "the MMC's impact show that lower achievers demonstrate the largest gains in academic achievement, they also suffer the most in attainment. And the academic gains are quite small compared to our best estimate of the decline in graduation rates" (Jacob et al., 2016, p. 11).

Another unintended consequence of the MMC may be declines in general overall achievement for high-skill students when schools place all students into what was previously considered the high-ability track or college preparatory track. Nomi (2012) found math skills declined for high-skills students on standardized tests when Chicago Public Schools mandated an algebra-for-all curriculum. Dynarski et al. (2012, p.7) found "very positive effects for students in the bottom quintile of academic performance …. Michigan's least prepared students reversed an earlier downward trend and, instead, increased their average ACT science scores in the years after MMC implementation." A Michigan study on the students in the highest-quintile of academic achievement after the MMC implementation would be beneficial.

French (2015) conducted an analysis of ACT scores before and after the implementation of the MMC at a small parochial school in southeast Michigan. She did not find a significant difference between the two groups. She was limited by the very small sample size (26-44 students for each year) and recommended the study be repeated on a larger sample size. French's research sample differs from the sample in the current study because her sample is from a small parochial school. The sample in the current study comes from students who have graduated from large public schools.

The target audience of a mandated college preparatory high school curriculum is the students who would not have taken the college preparatory classes without the mandate. Oakes

& Guiton (1995) and Lee & Ready (2009) found that students from families with lower SES, Black/African American students, and Hispanic students are less likely than students from higher SES families and White students to enroll in college preparatory curriculums in high school when they are offered. Community college students are also less likely to enroll in college preparatory curriculums in high school because community colleges do not have entrance requirements or specific required high school coursework. Additionally, community college students are not required to graduate from high school. A high school drop out can pass a General Educational Development (GED) test and enroll in a community college. Therefore, community college students are also the target audience of a mandated college preparatory high school curriculum.

Research that use samples containing high concentrations of the target audience are finding the mandated college preparatory high school curriculum is resulting in students being better prepared for college and improved student learning. For example, Toch et al.'s (2007) research on Chicago students had the same results as the current study: a rigorous curriculum produced improvements in student learning. Toch et al.'s (2007) sample can be considered the target audience of a mandated college preparatory high school curriculum because in 2007 Chicago Public Schools students were 48% Black/African American and 38% Hispanic (Chicago Public Schools, 2007). Of that population, 87% were eligible for free and reduced lunch (Center for Best Practices, 2011). Therefore, the rigorous curriculum reached a target audience and had an effect.

Cousineau (2012) also researched the MMC's effect on the target audience. He studied enrollment in remedial math at community colleges and found an upward trend throughout Michigan of recent high school graduates taking developmental mathematics from 1995 to 2011.

In 2011, the number plateaued. "The first graduating class meeting the MMC appears not to have increased the need for developmental mathematics at community colleges" (Cousineau, 2012, p. 36). Cousineau's findings are similar to the findings in the current study because he studied community college students. His data ended with the graduating class of 2011. The current study extends the time frame and subjects from Cousineau's study and reveals Cousineau's findings of a plateau in 2011 turned into a decrease in the need for remedial math, reading, and writing for 2011-2014.

Although the focus of the study was the effect of the MMC on community college students' preparedness for college level courses, the effects of gender, race, and free/reduced lunch (FRL) rate were also considered in the current study. Gender was found to be significantly related to math, reading, and writing college readiness. The current study's findings, that males are 1.434 times more likely than females to be at college level for math, support the findings by You (2010) and Chapman (2015) that genders learn differently.

You (2010) summarized research on gender difference in math learning by categorizing research that has been done on innate ability, attitude, motivation, interest, and performance behaviors. Her summary found conflicting conclusions. Some researchers found male-female differences in math achievement were due to brain differences and learning styles. Other researchers found gender did not play a role in math achievement, but rather how a student is socialized made the difference in a student's math capabilities. Additionally, Chapman (2015) explains the existence of the gender bias in a classroom setting. As recently as 2015 she recommended state departments of education should provide mandatory gender-equity resource modules to in-service teachers and address gender bias needs to all pre-service teachers. Chapman recommends educators need to be made aware of the bias they are reinforcing in their

students through socialization messages, inequitable division of special education services, sexist texts and materials, and unbalanced time and types of attention spent on boys and girls in the classroom. Chapman's conclusions are that genders learn differently and are treated differently. The current study found an achievement gap for math, writing, and reading based on genders.

Race was found to be significantly related to math, reading, and writing college readiness. This study's findings that Whites were more likely than Black/African Americans and Hispanics to be at college level for math, reading, and writing supports the findings by Bohrnstedt et al. (2015) and Zajda & Freeman (2014) that there are academic performance differences among ethnic groups. Scholars have examined the relationship between ethnicity and academic achievement for decades. Zajda & Freeman (2014, p. 15) summarized findings from the National Educational Longitudinal Study of 1988 and found substantial differences among ethnic subgroups. Bohrnstedt et al. (2015) performed a study on school composition of race groups and how it affects the achievement gap between the highest and lowest performing groups in school. They found when accounting for SES, student, teacher, and school characteristics, the achievement gap was greater among schools with the highest Black/African American student density than the schools with the lowest. The current study also found academic performance differences among racial groups.

The FRL rate was found to be significantly related to math, reading, and writing college readiness. Decreased FRL of the school the student graduated from is associated with an increased likelihood of being at college level for reading, writing, and math. The socioeconomic status (SES) of a student is a strong predictor of success in school and test scores (Sackett et al. 2009). The records in the current study did not include information on the students' SES. In place of using a student's SES in the current study, the FRL rate for the school from which he or

she graduated has been added to each record. The FRL rate is the percent of students who attend the school whose household family income is less than 185% of the poverty guideline.

It is meaningful to consider the FRL rates for the schools from which students graduated in lieu of individual SES in the current study because of Kahlenberg's (2013) conclusions that when studying student achievement it is more important to consider the poverty level of the school from which the student graduated than the individual students' SES.

> …. over and above individual students' socioeconomic status (SES), as the poverty level of the school goes up, the average achievement level goes down. In the last decade, the research has become even more convincing. A 2010 review of 59 studies on the relationship between a school's SES and outcomes in math found 'consistent and unambiguous evidence' that higher school poverty concentrations are linked with less learning for students irrespective of their age, race, or family's SES (p. 4).

Kahlenberg (2013) found low-income students who attend more-affluent SES schools outperformed low-income students who attend high-poverty schools where $2000 more per pupil was spent. High-poverty schools were defined as those in which at least 50 percent of students are eligible for free or reduced-price lunch. Therefore, the finding of the current study supports Khalenberg's findings that students from more-affluent SES schools outperform students from less-affluent SES schools.

However, there is no definitive SES definition in educational research. SES is a combination of family income, parental occupations and education, location of family residence. On the contrary, free or reduced lunch eligibility is clearly defined. Students are eligible for a reduced price lunch if their household income is less than 185% of the federal poverty guideline and for a free lunch if their household income is less than 130% of the poverty guidelines.

Therefore, free or reduced lunch eligibility is based solely on income, which is only one of the factors taken into consideration when defining SES. Kahlenberg's (2013) study supports using the FRL rate of the school from which the student graduated with his conclusion that as the poverty level of the school goes up, the average achievement level goes down.

Implications. In the current study, the researcher examined the entering students' placement levels for college courses. Insights into the curriculum's effects were sought and believed to be valuable to the field of K12, higher education, and state legislatures considering implementing and financing state-mandated curriculums or remedial education policies. Legislators seeking ways of improving success in college for their constituents can gain insight from the findings of the current study. School districts have unique and shared challenges in facing the state-mandated curriculum. The findings from the current study that community college students are 1.5 times more likely to place into college level classes in reading, writing, and math highlight the success of the hard work in implementing the MMC by teachers, administrators and school districts. Teachers and administrators had to modify course content and instruction, participate in professional development, share best practices, and adopt new textbooks (The Center for Local, State, and Urban Policy, 2010).

In Michigan, because of the MMC, the college preparatory high school curriculum is no longer the path followed primarily by high achieving students and high SES households. According to Lee & Ready (2009) and Oakes & Guiton (1995), low-income students are less likely to enroll in rigorous high school academic courses when they are offered because of parental input, teacher recommendations, lack of role models, and lack of knowledge about curriculum opportunities. The MMC established uniform course-taking patterns across all income levels and race groups. The MMC ensures that all students, including low-income and

minority students, enroll in rigorous academic courses. The current study found the community college students at this college who experienced the MMC were 1.5 times more likely to place into college-level math, reading, and writing courses. This author's findings differed with the studies that used nationally representative data or statewide representative data. The current study on community college students found improvement in student learning when a curriculum mandates college preparatory course sequences of four credits of math; four credits of science; four credits of English language arts; three credits of social studies; one credit of physical education and health; one credit of visual, performing, and applied arts; and an online learning experience as opposed to studies with national or state representative data that did not find improvement in student learning when a college preparatory curriculum was mandated. The current study matched the findings of the studies that used a similar sample of community college students or urban high school students and found improvement in student learning.

The MMC was legislated because jobs that did not require college degrees were dramatically decreasing in Michigan. Legislators believed the credentials necessary to get jobs in the future Michigan economy would require college degrees. The MMC was passed into law to mandate that all Michigan high school students would receive a high school education that would prepare them for college. Only the students who would not have been on a college preparatory path were impacted by the MMC. Those students were the target audience of the MMC.

Limitations. Though this current study offers many valuable insights for the implementation of a state-mandated college-preparatory curriculum for all high school students in a diverse setting adjacent to an urban area with students from low-middle socioeconomic families, it is limited to one community college located in a suburban area adjacent to a large urban setting that was willing to provide the student records for the study. This quantitative study

is a retrospective causal comparative study. Retrospective causal comparative studies require the researcher to investigate the effect of a treatment that has already occurred. Causal Comparative studies are limited because although a researcher may find a relationship between two variables, a causal relationship cannot be definitively identified. The current study controls for the potential influences of gender, race, and FRL of school attended on the student outcome. However, other factors may influence ATD rankings besides MMC. Those factors are detailed here.

It is unknown if the high schools from which the students in the current study graduated added an ACT Test Prep class to the high school curriculum during the years of the current study. If students participated in an ACT prep class, their ATD ranking would be slightly positively affected according to Briggs (2001). That effect was not controlled for in the current study. ACT test prep classes were added as electives to many high school curriculums when Michigan replaced the standardized MEAP exam with the ACT test in 2007, requiring all juniors in high school to take the ACT test as a standardized assessment.

It is unknown if the rising costs at four-year universities and Michigan's economic turbulence from 2008-2012 illustrated in Figure 1 diverted students from attending a university to attending the community college in this study. Martinez & Klopott (2005) found the most crucial predictor of college-going behavior is academic rigor in high school. Students planning on attending a university include more academic rigor in their high school class selection and studies than students who attend a community college. Therefore, the students who attended the college in this current study may have been better prepared because they had intended to go to a university but finances diverted them to attending a community college. This factor was not controlled for in the current study.

ATD ranking will be used instead of raw test scores because all students did not take the same test with the same grading scale. Therefore, ATD rankings allow the entrance exam results to be comparable for students who have taken different entrance exams with different scoring scales. However, the process of converting the entrance exam score to an ATD ranking is a limitation of the study. The entrance exam scores are converted to ATD rankings using the conversion tables shown in Appendix B. The tables in Appendix B are created by the faculty who teach the courses below college level and the first courses at college level for each subject and the associate dean of the division/department that the classes reside in. Faculty make their informed decisions on entrance exam score conversions to ATD rankings based on their experience in the classroom. For example, the entrance exam score is reviewed in the student record when a student is unsuccessful in a class; and trends are looked for in unsuccessful students' entrance exam scores. The faculty and associate dean also review studies that have examined success in college-level courses with correlating ACT, ASSET, and Compass scores. ACT (2012) provided one such study that correlates test scores with success in college classes.

Teachers and the associate deans take these pieces of evidence into consideration when they establish the conversion tables shown in Appendix B that convert the entrance exam scores to ATD rankings. The ranking is determined on a student-by-student basis depending on what test was taken. This process of determining ATD ranking is a limitation of the study.

Another limitation of the current study is that it is based on the ATD ranking variable being collapsed to two levels. Collapsing the variable enables the study to answer the research questions but potentially loses information in the process. Table 24 illustrates the collapsing.

Table 24

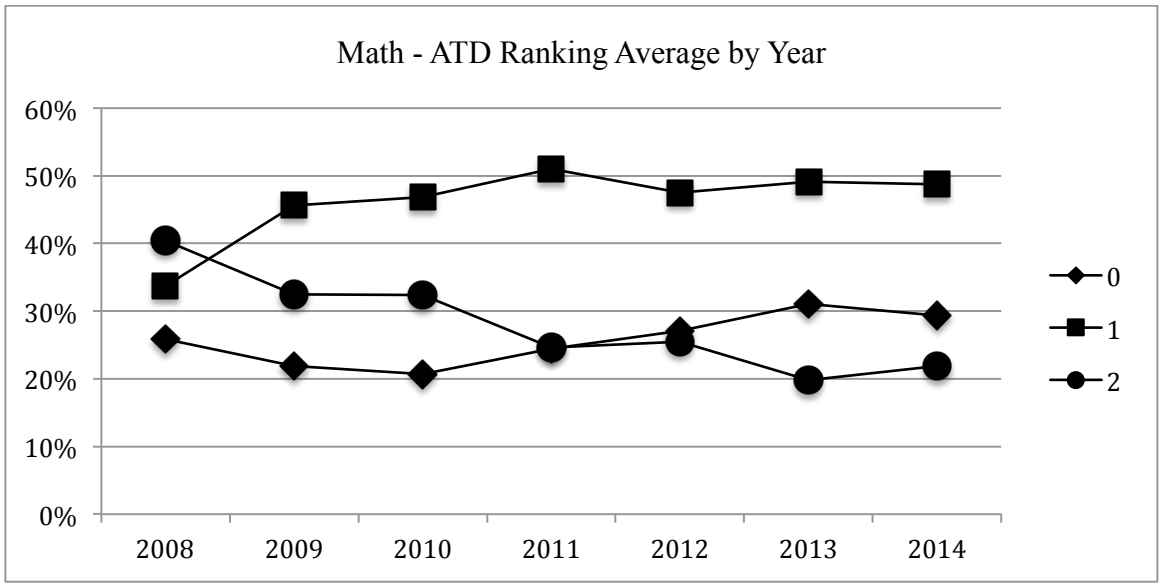
ATD Variable Collapsing

Original Variable ATD Ranking	New Variable ATD Ranking
-1 (one level above college level)	1 (at college level)
0 (at college level)	1 (at college level)
1 (1 level below college level)	0 (not at college level)
2 (2 levels below college level)	0 (not at college level)

If the MMC has better prepared a student for a college-level reading, writing, or math course, but the student is still not at college-level, the collapsed variable will not measure the improvement. Figure 8 shows the trends of the ATD rankings for math. The green and red trend lines show that the number of ATD equal to 1 rankings slightly rose from 2008 – 2014 while the number of ATD equal to 2 rankings slightly declined from 2008 – 2014. This improvement from two levels below college level to one level below college level would not register in the binomial logistic regression. The MMC may have had more of an effect on improving college preparedness for the students than has been found by the binomial logistic regression, but only students who were at college level were considered in the effect of the MMC in the binomial logistic regression.

Figure 8

Math ATD Ranking Average by Year



0=Student at college level
1=Student 1 level below college level
2=Student 2 levels below college level

Collapsing the ATD variable was necessary because keeping three ATD categories (0,1, 2) produced an error when an ordinal logistic regression was attempted. The error stated a large number (46%) of observed combinations had zero frequencies. For a regression to be meaningful, every combination of predictor variables must have many observations. The collapsed category of the ATD variable still served the purpose of the study by answering the research question: Are community college students better prepared for math, reading and writing college-level courses if they have experienced a high school curriculum mandated at the state level that includes a four-credit math course sequence, a three-credit science course sequence, four credits of English language arts, and three credits of social studies? The collapsed ATD ranking could still measure if students are better prepared for math, reading and writing college-level courses if they have experienced a high school curriculum mandated at the state level that

includes a four-credit math course sequence, a three-credit science course sequence, four credits of English language arts, and three credits of social studies.

The current study is also limited by the unknown curriculum taken by students graduating prior to 2011. Although the MMC was not yet in effect, students could have voluntarily elected to take the courses that were later required by the MMC. The researcher does not have knowledge of the courses the students did take in high school. If students took college preparatory classes before the MMC was implemented, their ATD ranking already reflected the treatment of the MMC in the pre-MMC group. The effects of the MMC measured by the binomial logistic regression would not be as high if there are students in the pre-MMC that took college preparatory classes. To measure the true effect of the MMC, those students would need to be removed from the study. That was not possible because the records in the current study removed all identifiers. Classes taken in high school were not part of the record received by this researcher.

The current study is limited by the unknown quality of the instruction received in the math, science, language arts, and social science classes mandated by the MMC. During the implementation phase of the MMC, teacher quality was a huge concern of the school administrators (Craft, 2008) and (Smith, 2011). All schools in Michigan needed to find and hire new teachers with strong math and science skills to deliver the content of the MMC. Although all students in the post-MMC group were required to take a sequence of math, science, language arts, and social science classes, the quality of the instruction varied from class to class and school to school. Likewise, the resources and supports available in the school to implement the curriculum varied from school to school. Although this could be considered a limitation, the

effects of the MMC measured by the binomial logistic regression captured this varied quality of teaching and support.

The binomial regression had significant p-values; however, the R-squared values for the models were small. Small R-square values indicate a substantial amount of variance in the dependent variable remains unexplained by the predictor variables. The small R-squared values may be a result of the potential predictor variables not included in the analysis. For example, high schools embedding ACT prep classes into curriculums, the restructuring of the second largest feeder school district, rising costs at four-year universities, and Michigan's economic turbulence were not included in the model. The R-square values were higher for math (13-19%) than for reading or writing (4-7%). Therefore, gender, race, FRL, and MMC better explained variations of the ATD rankings for math. However, the model was statistically significant for reading, writing, and math with a less than .1% chance that the relationship between the ATD ranking and gender, race, FRL, and MMC is due to random chance.

Recommendations

The recommendations are based on the findings of the current study that show the college preparedness of community college students has moved in a positive direction, but not all high school graduates since the implementation of the MMC are prepared for college-level classes. The findings of the current study also show an achievement gap still exists between races and social classes. The recommendations based on the findings of the current study focus on eliminating the need for remedial college education. The recommendations are aimed at state legislation, high school educators, and future research.

Eliminating the need for remedial college education. NCLB (U.S. Government, 2002) reauthorized the Elementary and Secondary Education Act, which was originally enacted in

1965. NCLB had measures for K12 schools that intended to close the achievement gap in K12 education for disadvantaged students by the 2013-2014 academic year. The United States Department of Education discussed needed reforms to address inequities of students and the persistent achievement gap after implementation of NCLB in *Blueprint for Reform*: "We must … address persistent gaps in student academic achievement and graduation rates" (2010, p.7).

This author concludes the achievement gap has not been eliminated because the findings of the current study shows an achievement gap still exists between race and SES groups. The Black/African American and Hispanic students in the current study were less likely than white students to place into college-level classes. Students who graduated from high schools with higher FRL rates were less likely to place into college-level classes. Young (2013) and Hewitt (2015) studied the effects of NCLB and concluded that NCLB did not eliminate the achievement gap. Hewitt (2015) describes the post-NCLB poor outcomes by highlighting the large persistent gap on standardized tests among African-Americans, Latinos, low-income students, and wealthier white students. Hewitt (2015) also describes how the high school completion rates, college enrollment rates, and college completion rates post-NCLB are also at the staggered levels by the same race and class groups as found on the standardized tests.

If only 29% of students who enter college with a need to take remedial classes before college-level classes graduate college within eight years, one can conclude that remedial education is not working in higher education. Some state legislatures have come to that conclusion and have eliminated funding for remedial higher education or placed limits on it. With the NCLB act, the federal legislature concluded K12 curriculums needed to 'fix' the achievement gap that exists between social classes and race groups before students get to college. NCLB increased the level of federal involvement in education and placed focus on the

lowest academic achievers. A spotlight was put on the academic achievement of racial groups, ethnic groups, socio-economically disadvantaged students, English language learners, and children with disabilities. With the NCLB act, schools were no longer only measured by the achievement of their general populations. However, ten years after NCLB was enacted, the achievement gap still exists (Young, 2013).

NCLB also mandates the use of effective educational practices based on scientifically based research that has been shown to reliably yield positive results (Simpson, LaCava, & Patricia, 2004). Dee & Jacob (2010) evaluated the impact of NCLB using nationally representative data by comparing National Assessment of Educational Progress (NAEP) scores before and after NCLB implementation in states that did not have the test-based accountability systems in place before NCLB. Their research had more positive outcomes of NCLB than Hewitt(2015) and Young (2013). Simpson et al.(2004) found statistically significant improvements in math scores in fourth and eighth grades and declines in reading scores in eighth grade. African American students, Hispanic students, and students eligible for subsidized lunch had the highest increase in math scores.

If NCLB did not fix the achievement gap in K12, the next natural conclusion would be to look at 'fixing' the achievement gap that exists before a five-year-old student arrives for kindergarten. Fernald et al. (2013, p.234) concluded "SES differences in verbal abilities are already evident in the preschool years" and suggested the early disparities "set children on particular trajectories with far-reaching consequences for later academic success" (p.235). When the NCLB was reauthorized in 2015 with the Every Student Succeeds Act (ESSA) (U.S. Government, 2015), one provision of the ESSA was increased access to high-quality preschool. Future studies may tell if high-quality preschool for students that historically have performed at

lower levels and whose parents cannot afford preschool is a step toward eliminating the achievement gap before it starts.

Eliminating the achievement gap before it starts would begin long before a child enters preschool or K12 school. A mother's education, socioeconomic status, prenatal care, and diet during pregnancy are factors in a child's success in school (Fernald et al., 2013). Educational and worldly opportunities prior to formal education at age five play a role in a child's success in school (Crook & Evans, 2014). An educated mother will have a higher socioeconomic status than an uneducated mother. A mother with a higher socioeconomic status is more likely to receive prenatal care and maintain a healthy diet during pregnancy (Fernald et al., 2013). An educated mother will share more words and build stronger language skills early in her child's life (Hart & Risley, 1992). A mother with a higher socioeconomic status is more likely to provide educational and worldly opportunities prior to a child's formal education commencing at age five (Crooks & Evans, 2014). An educated mother with a higher socioeconomic status is a big factor to eliminating the achievement gap.

Schools may not be the only factor in eliminating the achievement gap. A wider range of out-of-school services may be the key to fix the achievement gap that exists between social classes and race groups. Strengthening community-based programs and church groups in disadvantaged neighborhoods and providing afterschool academic and enrichment programs may break the cycle of lower educated mothers having lower educated children. Of course, these programs cost money.

Legislation. Can the achievement gap be legislated away? The factors that contribute to the achievement gap before K12 education commences at age five include but are not limited to a mother's education, the family's socioeconomic status, and a child's educational and worldly

opportunities prior to K12 education. These factors indicate that federal or state funding spent on K12 education, Head Start programs, and social service programs can impact the achievement gap of preschoolers, which in turn will impact the achievement gap in K12 and higher education.

State and Federal legislatures must provide adequate funding for the NCLB and MMC mandates that have been put in place. The Bush administration forecasted NCLB would require $1 billion additional federal appropriations to implement. Fusarelli (2004) estimated NCLB cost schools between $85 and $148 billion nationally. Implementing measurable goals focused on basic skills and essential knowledge, requiring annual testing in every grade, and expecting adequate yearly progress for disadvantaged students has cost much more than anticipated.

The MMC was implemented in 2005, and the first class to graduate following implementation of the MMC was the class of 2011. Per pupil state funding for education has dropped since the new curriculum has been mandated. School districts have had to offer more classes of higher-level courses with less money. Teachers have been hired, textbooks have been purchased, schedules have been overhauled, and professional development has been conducted to meet the requirements of the state-mandated curriculum. Those tasks have been done with lower budgets. The per pupil state funding for the two largest feeder districts to the community college used in the current study is provided in the table below. Table 25 provides actual funding and has not been adjusted for inflation, which would make the decrease in funding even more dramatic.

Table 25

State Funding per Pupil 2006-2015

	'05-06	'06-07	'07-08	'08-09	'09-10	'10-11	'11-12	'12-13	'13-14	'14-15
Top feeder district	$8768	$8978	$9026	$9082	$8648	$8632	$8332	$8332	$8362	$8412
2nd largest feeder district	$7335	$7469	$7557	$7660	$7506	$7490	$7190	$7190	$7246	$7296

(Michigan Senate Fiscal Agency, 2015)

With a significantly decreased budget since 2005, K12 public schools in Michigan must adhere to the mandates of the MMC and NCLB. Additionally, while continuing to meet regular budgetary commitments, schools must repair aging buildings, purchase new and constantly changing technology, pay the cost of a burgeoning retiree pool, and attempt to attract high quality teachers with competitive salaries. The primary recommendation of the current study would be to continue the college preparatory curriculum for all and allocate the resources necessary for its continued implementation.

Research on the effects of Michigan's common course sequence of mandated math, science, and language arts high school classes is in its infancy and continues to be a topic for discussion among other state legislatures. Florida and Texas passed bills in 2013 making algebra 2 optional instead of part of their graduation requirements to give students more flexibility in preparing for various career paths (Robelen, 2013). Therefore, the current study may be used in future debates in the Michigan Legislature if or when its members consider to make changes to the MMC. The findings that students from a community college adjacent to an urban setting were 50% less likely to need college remediation in math, reading, and writing should be shared

as an argument to not reduce the requirements of the current state-mandated curriculum. Students who experienced the MMC were less likely to need remediation and potentially saved tuition costs and Pell Grant disbursements at one community college in southeast Michigan. Every student that didn't need college remediation is much more likely to graduate from college and obtain a job in Michigan's workforce, which requires a college degree.

The current study also closes the loop for researchers. Craft (2008), Richards (2009), and Smith (2011) studied the MMC before it was enacted and called for a study of student outcomes to determine if the Michigan Merit Curriculum is meeting its goal of preparing students to attend college after high school. Their call was answered with this research, and the current study of student outcomes suggests the Michigan Merit Curriculum is better preparing students to attend college after high school. This should calm the fears of the school administrators in Richards' (2009) study that were concerned the MMC was not focused on increasing the quality of education high school students receive. The principals interviewed in Smith's (2011) study discussed concerns about redesigning courses, providing sufficient professional development, and spending valuable class time on common assessments. The interviewed principals feared the MMC changes would not produce the results legislation intended. The current study provides findings that the MMC did produce positive results

High School Educators. The MMC imposed many tasks on high school educators. Some examples of tasks include teachers having to modify course content and instruction, participate in professional development, share best practices, and adopt new textbooks (The Center for Local, State, and Urban Policy, 2010). Teachers should learn that the result of their hard work has produced students better prepared for college. High school administration should share the

current study's findings with teachers and parents who were apprehensive about the new state-mandated curriculum.

To achieve greater effects, teachers and administrators could consider the research findings of Burris & Welner (2005) who studied the Rockville Center school district in New York. Rockville Center school district taught a high-track curriculum to all students starting in middle school. Rockville provided every-other-day support classes in math, science, and language arts to students who needed additional help. The support classes allowed teachers to pre- and post-teach topics to students needing additional reinforcement. Burris & Welner (2005) measured the success of Rockville's success by comparing the number of Regents diplomas earned by the district. The New York State Regents diploma requires students to pass a minimum of eight end-of-course Regents examinations, including two in mathematics, two in sciences, two in social sciences, one in language arts, and one in a foreign language. The results of teaching the high-track curriculum to all students starting in middle school resulted in the percent of regular education Black/African American students earning a Regents diploma increasing from 23% to 75% and the percent of regular education White or Asian American students earning a Regents diploma increasing from 54% to 98%. The FRL rate of the students in the Rockville Center school district was not noted in the research of Burris & Welner (2005) but was determined to be 12% by this author. The 12% FRL rate is approximately 1/6 of the average FRL rate of the schools from which the students at the southeast Michigan college graduated. The very low FRL rate in Rockville may be a contributing factor to the clear and compelling improvement in academic achievement when all groups were taught a high-track curriculum starting in middle school.

Recommendations for future research. This quantitative study is conducted at one community college that was willing to gather the data to be analyzed. This researcher recommends that more community colleges provide the data necessary to broaden the scope of this research and the same analysis be done on their data. The college in the current study has an urban, low to middle socio-economic population. Two more community colleges reside within the culturally diverse setting of southeast Michigan adjacent to or within the same urban setting. Using Ipeds data and assuming a similar proportion of remedial enrollment and effect of the MMC on these two settings, a potential tuition and Pell Grant savings has been estimated. The Table below shows the estimates. Table XX below estimates raising academic achievement in high school curriculums has resulted in 369 more college graduates per year at the three colleges in the southeast Michigan setting.

Table 26 and 27 are estimates based on the findings of the college studied in this research. Performing the same research at the other two community colleges that reside within the culturally diverse setting of southeast Michigan adjacent to or within the same urban setting would enable the research findings to lend to generalizability within low to middle socio-economic settings adjacent to urban settings.

Table 26

Estimate of Tuition/Pell Grant Money Saved at Two More Community Colleges

Colleges adjacent to or within urban area	Yearly First Time in College Enrollment	Enrollment of Recent Public High School Graduates / year	Pell Grant Recipients	Tuition per Remedial Class	Potential Tuition Savings / subject	Potential Federal Pell Grant Savings / subject
College 2	2217	600*	37%	$417	125,000	47,000
College 3	4353	1176*	60%	321	189,000	113,000
* Estimated based on Ipeds Data and ratio at college in study						

(National Center for Education Statistics, 2016)

Table 27

Estimate of Increased Number of Graduates as a Result of the MMC

Three colleges adjacent to or within urban area	Enrollment of Recent Public High School Graduates / year	Projected number who would graduate within eight years before MMC 29% x	Projected number who would graduate within eight years after MMC 29% x times 1.5
College studied	775	225	338
College 2	600*	174	261
College 3	1176*	341	511
Total	2551	741	1110

*Estimated based on Ipeds Data and ratio at college in study

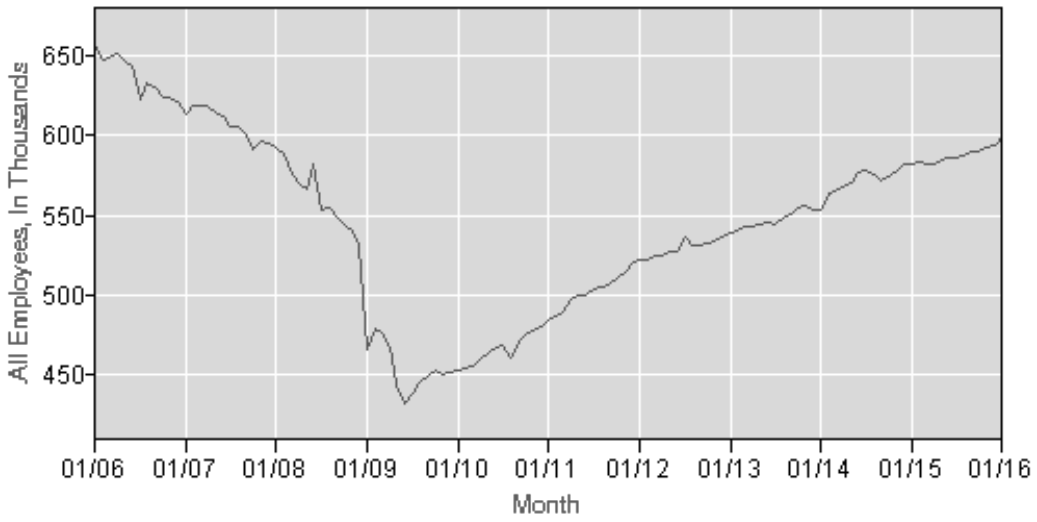
This author recommends studying the growth of industry in Michigan since 2010. Michigan Governor Granholm wanted to attract more companies, businesses, and industries to Michigan with a well-educated workforce.

> They need a flow of human capital -a skilled workforce to give Michigan's businesses an edge when competition is fierce and margins are tight. In the last century, businesses came to Michigan looking for strong backs. Today, they also need strong minds ready for continuous learning, skilled hands, and an ethic of excellence. (Granholm, 2004, p. 1)

Figure 9 and 10 show the number of jobs in the manufacturing sector and construction sector have risen since 2010. Understanding the reason for the increases would require interviewing employers and asking "Why Michigan?" Was the promise of an educated workforce in the future a draw?

Figure 9

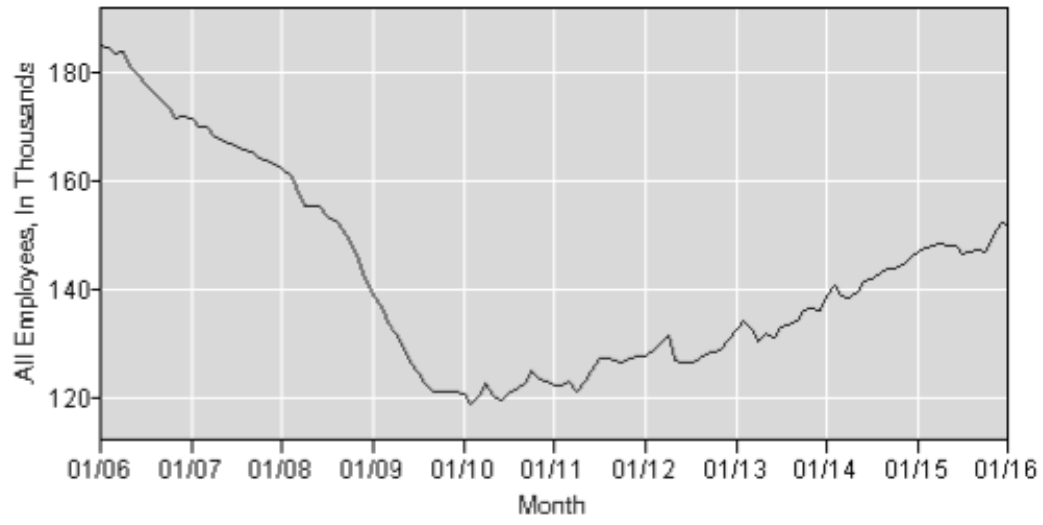
Michigan Statewide Manufacturing Employees 2006-2016



(United States Department of Labor, 2016)

Figure 10

Michigan Statewide Construction Employees 2006 - 2016



(United States Department of Labor, 2016)

This author recommends studying the impact the MMC has had on employers seeking to hire high school graduates without a college education. Employers hiring entry-level applicants seeking employment after high school graduation such as armed forces' recruiters in Michigan, retail establishments and service industries should be interviewed and asked if recent Michigan high school graduates are better-qualified after the implementation of the MMC. This would complement studying the growth of industry in Michigan.

The author recommends researching how students for whom English is a second language (ESL) or students who are learning the English language (ELL) have been effected by the MMC. Have there been unintended consequences for ESL/ELL students as a result of the MMC? As stated in the discussion, the unintended consequences that Dynarski et al. (2012) found from a statewide sample of students was a decline of about two percentage points in the graduation rate. Are ESL/ELL students disproportionately represented in that decline? Likewise, have schools with more resources and support to implement the MMC done a better job of preparing students for college? A qualitative study with interviews of high school principals involved in the MMC implementation may produce insights into how the implementation produced students better prepared for college.

Has the MMC made an impact on the completion of postsecondary education? Is the percentage of "first time in college" students completing their associates' or bachelors' degree increasing since the MMC has taken effect? Research on college completion would be a validating follow-up research study for the MMC's intent. For example, the pre-MMC/post-MMC model could be used with college completion as the dependent variable instead of ATD ranking. The intent of the MMC was to provide job opportunities for Michigan high school graduates. The job opportunities dried up for applicants without a college degree when

manufacturing jobs left Michigan. The MMC was intended to prepare all students for college. Students that do not need to take remedial classes are much more likely to graduate from college. The current study only looks at students' preparedness for college-level classes. Does the increased preparedness for college-level classes translate into an increase in college completion? A true measure of the intent of the MMC would be answering the following question: are more Michigan high school graduates able to obtain living-wage jobs that require a college education after they experience the MMC?

Conclusions

The curriculum in Michigan high schools changed dramatically in 2006. Prior to the Michigan Merit Curriculum enactment in 2006, the only statewide requirement was one semester of civics (Walker, 2006). All graduates of Michigan public high schools since the graduating class of 2011, have taken a four-credit math course sequence, a three-credit science course sequence, four credits of English language arts, and three credits of social studies. In light of this profound shift in high school curriculum, the current study investigates if the narrow set of academic courses improved the preparedness of entering community college students for college level math, reading and writing classes. This author hypothesized the state-mandated high school curriculum would make students better prepared for college math, writing, and reading courses as evidenced by ATD rankings**.** This author's findings bear this hypothesis out. By requiring all students to meet higher academic standards to graduate, community college students from high schools with above average FRL rates that are 8% Black/African American and 8% Hispanic are 1.5 times less likely to need remedial math, reading, and writing courses at the onset of their college career. Additionally, findings suggest the achievement gap still exists for disadvantaged groups 15 years after NCLB was legislated and 4 years after the MMC was implemented. As a

result of these findings, the author recommends that focus be placed on properly funding the current education initiatives and public service programs before legislating any new education reforms. Funding for schools has dropped dramatically since NCLB and MMC. While mandating a rigorous high school curriculum has shown high school graduates attending community college are better prepared for college-level classes, the unintended consequences of the MMC must be watched. High school drop-out rates were a concern and have currently increased slightly. The performance of higher skilled students must be watched for a decline too.

The legislation to mandate all students take college preparatory classes in high school is clearly driven by Michigan's economic activity change that reduced the number of career opportunities that do not require a four-year college degree and earn a living wage. These findings suggest the legislation produced a positive outcome for community college students, but more must be done. The achievement gap starts before a child enters kindergarten and is remarkably persistent. White students and students from high-SES backgrounds enjoy a remarkable advantage throughout their education.

The current study is significant because political leaders, university administrators, and K12 school administrators are locked in debates about financing in K12 education, financing college, and best practices in preparing students for college. The current study indicates that money spent on teaching a rigorous college preparatory curriculum to all high school students is money well spent. The MMC may have reduced the amount of federal financial aid money spent on remedial education in college and increased the number of students who will ultimately obtain a job that requires a college degree. Additionally, the current study is significant because it focuses on students improving in the areas of math, writing, and reading. Those subjects are part of a school's general education requirements. General education requirements are based on what

all graduates of a college must know to graduate without regard to their individual degree programs to prepare for the workforce, college, and the community they live in.

Michigan's Approach is Working. In 2012, Ohio joined a national trend of 21 other states to eliminate remedial classes at four-year universities. Students need to earn a 22 in math and an 18 in English on the ACT to attend a four-year university in Ohio or students must attend a community college to receive remediation in those subjects to become eligible to attend a university. "Declaring community colleges respected points of entry for students, Ohio's legislature voted in 2007 to phase out state funding for remedial education at university main campuses starting in 2014-15." (Pant, 2012, p.1)

Ohio's position will lead to a greater deterioration in the number of students from low SES families that will attain a college education (Attwell, 2006). The for-profit higher education institutions in Ohio and nationwide will fill the role from which the public universities are pulling out. (Ruch, 2001) This option is most upsetting when considering that students who need remedial classes have the most to gain from a four-year university education. Beyer (2012) stated,

> Students learn about core democratic value of equality, which dictates that Americans have the basic right of equal treatment regardless of background, belief, economic status, race, religion or sex. In addition, they learn about core democratic value of justice, a fundamental belief that American society offers the same benefits and has the same obligations to all its citizens. (p. 7)

The elimination of state funding for remedial education at universities in Ohio and 21 other states' universities teaches the students that American society does *not* offer the same benefits and do *not* have the same obligations to all its citizens. Knowing that the achievement gap has

not been closed by the MMC or NCLB and the achievement gap is largely influenced by a mother's socioeconomic status and education, Ohio's approach may be widening the achievement gap if it leads to a greater deterioration in the number of future mothers from low SES families that will attain a college education. Michigan's alternative to Ohio's remedy for students needing remediation should be used as an example to other states on how to reduce the need for college remediation.

One of Michigan Governor Granholm's intentions of the MMC was to attract companies to Michigan because of its well-educated workforce. The MMC is an attempt to realign the Michigan's educational system with the changing economy, and to prepare high school students for the challenges they will face in Michigan's economy that will depend on a well-educated workforce that can compete on a global stage. Ann Arbor, Michigan has been attracting tech companies since Google moved over 400 employees of the company's main advertising division to Ann Arbor in 2006 (Williams, 2015). Google continues to grow its operations in Ann Arbor, and this move is attracting other tech companies to Michigan. Harbor Springs and Ann Arbor are home to a tech incubator, Coolhouse Labs, which has launched several tech startups in those cities (Henderson, 2015b). University of Michigan's students and graduates are the big draw for these companies. The companies appreciate the service, retail, and real estate of the state, which was Governor Granholm's intention. The number of manufacturing and construction jobs in Michigan is on the rise again since the MMC was implemented in 2006.

The MMC was crafted around the philosophical belief that "all students will need postsecondary learning opportunities beyond high school" (Michigan Department of Education, 2007, p.1). The goals of ESSA are to "Ensure states set high standards so that children graduate high school ready for college and career" (Executive Office of the President, 2015, p.2).

Education researchers are in agreement that higher educated mothers produce higher educated children (Fernald et al., 2013). To put the building blocks in place for generational change, the cycle of students entering kindergarten with an academic gap to their peers must be broken. Funding preschool programs for disadvantaged children is important, but simultaneously putting programs in place to better educate the mothers of future children will bring about the generational change needed to eliminate the academic gap. The MMC is one such program. The current study found that more community college students were prepared for college after attending high school with a college preparatory curriculum.

Although not all studies find mandating a college preparatory high school curriculum produces students better prepared for college, studies with samples of community college students or disadvantaged students find student achievement improves with a mandatory college preparatory high school curriculum. The MMC is one critical step forward in breaking the cycle of our most vulnerable students becoming the parents of the next generation of our most vulnerable students. This study's findings supports directing resources toward helping all children persevere through a college preparatory high school curriculum. Necessary funding must back this critical step as opposed to repetitive funding decreases. For future children to enter kindergarten on equal academic footing with their classmates, their parents need a chance to enter college without needing remedial education. The MMC is a step in providing a limitless future to students from all race and social class groups.

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Appendix A

Table 28

State Mandated High School Curriculums in 2001

State	Courses	ELA	Social Studies	Math	Science	PE	Arts	Tech	1st Grad Class
Colorado	0								
Iowa	0								
Massachusetts	0								
Nebraska	0								
Pennsylvania	0								
Michigan	0.5		0.5						
North Dakota	17	4	3	2	2	1	0	0	
Minnesota	24	5	4	3	2	3	0	0	
Alaska	21	4	3	2	2	1	0	0	1978
Illinois	16	3	2	2	1	0.5	0	0	1988
Missouri	22	3	2	2	2	1	2	0	1988
California	13	3	3	2	2	2	1	0	1989
Maine	16	4	2	2	2	1.5	1	0	1989
N.Hampshire	19.75	4	2	2	2	1.25	0.5	0.5	1989
Rhode Island	18	4	2	3	2	0	0.5	0.5	1990
New Mexico	23	4	3	3	2	1	0	0	1990
Montana	20	4	2	2	2	1	2	0	1993
D.C.	23.5	4	3.5	3	3	1.5	2	0	1995
Arizona	20	4	2.5	2	2	0	1	0	1996
Maryland	21	4	3	3	3	1	1	1	1997
Hawaii	22	4	4	3	3	1.5	0	0	1997
Utah	24	3	3	2	2	2	1.5	1	1997
Tennessee	20	4	3	3	3	1	0	0	1998
Delaware	22	4	3	3	3	1.5	0	1	2000
Alabama	24	4	4	4	4	1.5	0.5	0.5	2000
Idaho	21	4.5	2.5	2	2	0.5	0	0	2001
Kansas	21	4	3	2	2	1	0	0	2001
Georgia	22	4	3	4	3	1	0	0	2001
Oregon	22	3	3	2	2	2	1	0	2001
Texas	22	4	3	3	2	2	0	1	2001
South Carolina	24	4	3	4	3	1	0	1	2001
Mississippi	20	4	3	3	3	0.5	1	1	2002
Vermont	20	4	3	3	3	1.5	1	0	2002

State	Courses	ELA	Social Studies	Math	Science	PE	Arts	Tech	1st Grad Class
Kentucky	22	4	3	3	3	1	1	0	2002
Virginia	22	4	3	3	3	2	1	0	2002
Wyoming	13	4	3	3	3	0	0	0	2003
Nevada	22.5	4	2	3	2	2.5	1	0.5	2003
Louisiana	23	4	3	3	3	2	0	0	2003
Oklahoma	23	4	3	3	3	0	2	0	2003
Florida	24	4	3	3	3	1.5	1	0	2003
West Virginia	24	4	3	3	3	2	1	0	2003
Wisconsin	13	4	3	2	2	2	0	0	2004
Connecticut	20	4	3	3	2	1	1	0	2004
Indiana	20	4	2	2	2	1	0	0	2004
North Carolina	20	4	3	4	3	1	3	0	2004
Arkansas	21	4	3	3	3	1	0.5	0	2004
Ohio	21	4	3	3	3	1	0	0	2004
South Dakota	22	4	3	2	2	0	1	0.5	2004
New Jersey	22	4	3	3	3	0.75	2	0	2005
New York	22	4	4	3	3	2.5	1	0	2005
Washington	19	3	2.5	2	2	2	1	0	2008

(National Center of Education Statistics, 2001)

Appendix B

Table 29
Test Score to ATD Ranking – Reading and Writing on ACT

ATD RANKINGS		ACT	
Reading Level	Writing Level [Writing]	RS	WS
0	0	18+	6+
1 or more	1 or more	< 18	< 6

(Anonymous College Research Department, 2015)

Table 30
Test Score to ATD Ranking – Math on ACT

ATD	ACT
Math Level	
0	22+
1 or more	< 22

(Anonymous College Research Department, 2015)

Table 31
Test Score to ATD Ranking - Reading and Writing on ASSET and Compass

ATD RANKINGS		ASSET		Compass	
Reading Level	Writing Level [Writing]	RS	WS	RS	WS
3 or more	3 or more	> 32	> 31	> 50	> 22
2	2	23-32	23-31	0-50	0-22
1	2	33-42	23-31	51-83	0-22
0	2	43-53	23-31	84-100	0-22
2	0	23-32	32-43	0-50	23-77
1	1	33-42	32-43	51-83	23-77
0	1	43-53	32-43	84-100	23-77
1	0	23-32	44-54	0-50	78-100
0	0	33-53	44-54	51-83	78-100
0	0			84-100	78-100

(Anonymous College Research Department, 2015)

Table 32
Test Score to ATD Ranking - Math on Compass

Placement	Math Level	Compass	
Math 074	2	CTPA Pre-algebra	LT 39
Math 080/100	1	CTPA Pre-algebra	39+
Math 080/100	1	CTAL algebra	LE 45
Math 110	0	CTAL algebra	46-65
Math 115/121/140	0	CTAL algebra	66+
Math 115/121/140	0	CTCA College algebra	LE 50
Math 153/175	0	CTCA College algebra	51+
Math 175	0	CTTR Trigonometry	LE 50
Math 180	0	CTTR Trigonometry	51+

Table 33
Test Score to ATD Ranking - Math on ASSET

Placement	Math Level	ASSET	
Math 074	2	ATNS Numerical Skills	LT 40
Math 080/100	1	ATNS Numerical Skills	40+
Math 074	2	ATEA Elementary algebra	LE 33
Math 080/100	1	ATEA Elementary algebra	34-45
Math 110	0	ATEA Elementary algebra	46+
Math 080/100	1	ATIA Intermediate algebra	LE 36
Math 110	0	ATIA Intermediate algebra	37-45
Math 115/121/140	0	ATIA Intermediate algebra	46+
Retest on Int. Algebra Test		ATCA College algebra	LE 36
Math 153/175	0	ATCA College algebra	37-44
Math 180	0	ATCA College algebra	45+

(Anonymous College Research Department, 2015)